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EDITORIAL

A new chapter for an integrated rabies research, surveillance, prevention and control in Colombia: the commitment of the Rabies In The Americas (RITA) conference 2023

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Rabies continues to be a public health problem in particular low and middle-income countries, including Venezuela, Haiti and Bolivia in the Americas[1-3]. In this context, continuous research and education in the field are critical to improve control and eliminate this deadly viral zoonotic disease. The opportunity to organize the Rabies In The Americas (RITA) Conference began for Colombia when doctors Maria Camila Pardo and Victor Lugo embarked on this adventure. Doctor Pardo presented a poster at RITA 2017 in Calgary, Canada, about the situation in Colombia among domestic animals, showing that the unvaccinated cats, no longer the dogs, are the animals that have mainly infected humans in recent years. Unvaccinated cats are infected by bats or other wild animals with the virus.

Doctor Lugo, a Colombian veterinarian, had a case of canine rabies in his clinic in Manizales a few years ago. He was surprised by the lack of practical knowledge that the doctors he contacted had about the post-contact prophylactic protocol to follow in humans. As he is the organizer of the largest Annual Veterinary Conference in Colombia (around 2,500 veterinarians attending), at the end of 2018, they presented to the international RITA committee the proposal to bring RITA to Colombia, which was accepted. At the beginning of 2019, the two Colombian local committees were organized, the scientist and the logistician. Unfortunately, due to the COVID-19 pandemic, RITA 2020 in Pereira, Colombia did not occur. During that year, a work network was created that generated the writing of the book chapter "History of Rabies in Colombia", which is part of the book "History of Rabies in the Americas", edited by Dr. Charles Rupprecht. The experience of writing that chapter allowed us to understand the evolution, progress, successes, and failures of the country regarding the prevention, control and surveillance of the disease in terms of anti-rabies vaccination, both for animals and humans, epidemiological surveillance, health education and vaccine production. Some of the findings related to this Colombia chapter include the critical efforts and advances in 1. Anti-rabies vaccination campaigns in dogs from the 70's, which were led from Cali, Valle del Cauca, with a participatory approach with the community and which were subsequently modelled by other countries in the region and thus contributed to reducing human rabies transmitted by dogs in the following decades[4,5]; 2. Production of vaccines for veterinary and human use pre-exposure and post-exposure, strengthening capacities through international cooperation; 3. Epidemiological surveillance in humans and animals (wild and domestic)[6], 4. Identification and control of disease foci in outbreaks of production animals, 5. Control of the bat population, 6. Production of anti-rabies serum, and 7. Mapping of risk areas in the country.

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This year's version of the Global Webinar of the Rabies In The Americas (RITA) Conference examines the role of the cat as an emerging factor that threatens public health in the Americas in the context of the transmission of the wild cycle. It is of particular interest to continue this discussion approach, given that in the last seven years, there have been six cases of human rabies in the country's central region, where the cat could be identified as the central intermediary of the transmission of the wild lineage. Likewise, considering that the cat is currently considered a relevant actor in the transmission of rabies to humans, whose aggression events are around 13% of those reported by the National Institute of Health of Colombia[7], prevention, surveillance and control strategies with a focus on This transmission route will be an essential part of the integrated efforts to contain rabies in the country.

On the path of progress in research, surveillance, prevention and control of human and animal rabies in Colombia, the organization of The Rabies in The Americas (RITA) Conference is a positive milestone that will have an impact not only on the generation of inter-institutional alliances to strengthen capacities that ensure that the country can advance and achieve the goals of the Regional Plan for the elimination of canine rabies 2024-2030, also because its development in the country will be the anchor to support all the recommendations that emerged from REDIPRA 17, held in Bogotá, Colombia, October 12-14, 2023. We want RITA 2023 to be a new chapter for more integrated and articulated work between all the actors involved in the country's research, prevention, surveillance and control of rabies. We know that the generation of relevant scientific evidence according to the needs of the territories, especially the most remote ones where the most difficulties exist, to ensure preventive actions is a priority for the Universidad La Salle, Bogotá, Colombia. From the Organizing and Scientific Committee of RITA Colombia 2023, we have committed ourselves to this path, and we hope that this event will be of the most significant benefit for all the participants who will be in person between October 16 and 19 and virtually on October 20.

Rabies control, approaches and targets for elimination require a continuous commitment to research and interdisciplinary work, including the One Health approach. Therefore, the comprehensive rabies care approach must be carried out under the One Health perspective, based on three fundamental objectives, as stated before:

- **Objective 1:** For the effectiveness of vaccines, medications, tools and technology; Reduce the risk of rabies in humans; Improve awareness and education; Increase access to healthcare, medications, and vaccines; Vaccinate dogs.
- **Objective 2:** Generate, innovate and measure impact. Provide guidance and data. Effective policies and guides Ensure reliable data that enables effective decision-making.
- **Objective 3:** Maintain commitment and resources. Leverage multi-stakeholder participation. Demonstrate the impact of activities carried out under the United Against Rabies collaboration.

Improving the control and elimination of rabies in the Americas is a crucial public health goal. The successful control and elimination of rabies in the Americas require sustained efforts, resources, and a multi-pronged approach. Adapting strategies to the specific challenges and contexts of different regions within the Americas is crucial. In the current special issue, abstracts of conferences and presentations are included.

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CONTENIDO

INAUGURAL CONFERENCE

IS5o - The Global Strategic Plan to end human deaths from dog-mediated rabies by 2030
Rachel Tidman **Pág. 13**

IS4o - Colombian experience in rabies control and prevention
Jairo Hernández **Pág. 13**

IS3o - Colombian experience in prevention and control of rabies from the agricultural sector
Edilberto Brito Sierra, Diana Patricia Dallos Rodríguez, Andrés Felipe Osejo Varona, Francy Paola Monroy Álvarez **Pág. 13**

IS2o - A validated sandwich ELISA immunoassay for the quantitation of rabies glycoprotein as a tool for vaccine formulation and its correlation with NIH potency test
Priscila Almario Falla, Verónica Rincón Forero, Zulma Roció Suarez Moreno, Jose Manuel Granados, Jorge Ossa, Leonardo Ladino, Zaida Liliana Cardenas, Yanira Chaparro, Oscar Sua, Diana Calderon **Pág. 14**

IS1o - History of rabies in Colombia: the time for an intentional One health approach is now
Natalia Margarita Cediel Becerra, Maria Camila Pardo, Luis Joaquín Polo Terán, Luis Carlos Villamil Jiménez **Pág. 14**

HUMAN RABIES AND PROPHYLAXIS

HP2o - Clinical Impact of Rabies: Importance of Evidence-Based Guidelines
Alfonso J. Rodríguez-Morales **Pág. 14**

HP1o - Clinical approach to rabies under one health lens
Wilmer Villamil **Pág. 15**

HP3o - Human rabies risks following exposure: Development of a rabies homunculus using an Artificial Intelligence tool
Stephen Scholand **Pág. 15**

HP4o - Comparison of International Rabies Antibody Reference Standards
Susan Moore, Cassidy Keating, Samantha Pralle **Pág. 15**

HP5o - Cultural practices related to aggressions by potentially rabies-transmitting animals in Colombia. 2007 – 2009
Luis Joaquín Polo Terán, Leonardo Montenegro Martínez **Pág. 15**

HP6o - Development of SYN023 Anti-Rabies mAb Cocktail
Eric I TSAO **Pág. 16**

HP7o - Rabies and Dog Bite Prevention Training in Southwestern Kenya: Collaborating with Local Communities
Jerlyn Sponseller, Leonard Kibet, James Nayetuni, Terence Scott, Thais Vila **Pág. 16**

- Prophylactic mass immunization measures in response to the rabies outbreak in indigenous children from Pradinho, Bertópolis, MG, Brasil, 2022
Dilceu Silveira Tolentino Junior, Santos Vasconcelos Marques, Maryana Santos Vasconcelos Marques, Roberto Carlos De Oliveira **Pág. 16**

HP8o - Training in the appropriate approach in the first level of care of the patient exposed to the rabies virus by an animal susceptible to suffering from this zoonosis aimed at doctors and nurses in social service
Alma Deyanira Aguilera Acosta **Pág. 16**

EPIDEMIOLOGY AND SURVEILLANCE

ES1o - Rabies epidemiology in Americas and the Caribbean
Vigilato, Marco Antonio Natal1; Rocha, Felipe1; Buzanovsky, Lia Puppim1; Sanchez Vazquez, Manuel José1; Lima, Daniel Magalhães1; Molina-Flores, Baldomero1; Cosivi, Ottorino **Pág. 17**

ES3o - Variant typing of rabies virus by sequencing the LN34 amplicon: a cost-efficient method for genetic typing
Vaughn Wicker, Rene Condori, Crystal Gigante, Hui Zhao, Yu LI **Pág. 17**

ES4o - The widespread Tadarida brasiliensis population influences the distribution of rabies virus in Chile: preliminary results
Zulma Rojas-Seren, Daniel G Streicker, Verónica Yung, Alice Broos, Haris Malik, Michelle Lineros, Julio Benavides **Pág. 17**

ES5o - An integrated spatial epidemiological approach to livestock rabies elimination in Brazil: the co-distribution of equine and bovine rabies in 2010-2019
Holly Crompton, Cassiano Victäia, Marco Vigilato, Ricardo Dias, Ricardo Soares magalhaes **Pág. 18**

ES6o - Evolution of cases of aggression by suspicious animals and trend of human rabies in Haiti 2017-2022
Parlo Cesar ST VIL **Pág. 18**

ES7o - Fifty years of the National Rabies Control Program in Brazil under the One Health Perspective
Silene Manrique Rocha, Maria Cristina Schneider, Kyungduk MIN, Phylllis C. Romjin, Nelio B.Morais, Lucía Montebello, Wilson UIEDA, Sofia Sciancalepore, Volney Camara, Ronir Radgio, Albino Belotto **Pág. 18**

ROUND TABLE: ¿WHICH ARE THE REGIONAL CHALLENGES TO ACHIEVE THE CANINE RABIES FREE STATUS?

ES8o - Approach to rabies in Argentina
Natalia Casas **Pág. 18**

ES9o - Strategies after the elimination of rabies transmitted by dogs in Mexico
Verónica Gutiérrez Cedillo, Ignacio Antonio Chávez Flores, Jose Ramón Fernández Colon, Ruy López Ridaura **Pág. 19**

ES26o - Regional challenges to achieving rabies-free status: BrazilSilene
Manrique Rocha **Pág. 19**

VACCINES AND ANTIVIRALS

VA1o - Oral rabies vaccination of dogs – new recommendations for field application and integration into dog rabies control programmes
Thomas Müller, Conrad M Freuling, Richard Chipman Ryan Wallace, Rachel Tidman Ad Vos **Pág. 19**

VA2o - Feasibility of oral rabies vaccination of dogs in Mexico: bait acceptance and immunogenicity studies
Verónica Gutiérrez Cedillo, Luis Antonio Montoya Mondragón, Jose Ramón, Fernández Colon, Katharina Bobe, Ad VOS, Luis Armando Lecuona Olivares, Ruy López Ridaura **Pág. 19**

VA3o - Large scale ORV campaigns targeted at free-roaming dogs in Namibia
Conrad Freuling, Frank Busch, Beatrice Shikongo, Nzwana Silume, Albertina Shilongo, Thomas Muller **Pág. 20**

VA4o - The Pathway to approval of an oral dog vaccine bait
Adriaan VOS **Pág. 20**

VA5o - The interface of arctic foxes and free roaming dogs in northern communities in Alaska and Canada. VA5o
Karsten Hueffer, Ryan Wallace, Richard Chipman **Pág. 20**

GEORGE BAER AWARD

GBA1o - Pradinho rabies outbreak, Brazil: Response actions and their intervening factors
Dilceu Silveira Tolentino Junior **Pág. 21**

IVANETE KOTAIT AWARD

Early transcriptional modulation of SLC genes during rabies pathogenesis: possible crosstalk with glutamatergic pathways and neuronal protection in the brain
Victor Bastos, Adriel Leal Nóbile, Dennyson L. M. da Fonseca, Fernando Y. N. do Vale, Sara de Souza Pereira, Vinicius Pacheco, Cássia N. S. Moraes, Pedro Fernando da Costa Vasconcelos, Livia Medeiros Neves Casseb & Otavio Cabral-Marques **Pág. 21**

WILDLIFE RABIES CONTROL

WR1o - What are wildlife and people telling us? Considerations and conundrums in wildlife rabies management
Richard B.Chipman, Kathleen M. Nelson, Jordona D. Kirby, Amy J. Davis, Luis Lecuona, Charles E. Rupprecht, Amy T. Gilbert **Pág. 23**

WR3o - Exploring Rabies Transmission Dynamics at the Urban-Rural Interface: Engaging Student Citizen Scientists through Remote Camera Technology
Scott Bender, David Bergman **Pág. 23**

WR4o - Rabies virus serosurvey of the small Indian mongoose (Urva auropunctata) across multiple habitats in Puerto Rico, 2014-2021
Are Berentsen, Mel Rivera Rodriguez, Fabiola Torres-Toledo, Amy Davis, Richard Chipman, Amy Gilbert **Pág. 23**

WR2o - Investigation into arctic fox oral rabies vaccination to reduce the rabies risk in Churchill, Canada
Alexandra Jerao **Pág. 23**

WR6o - Immunogenicity of recombinant live rabies virus vaccines in raccoons
Amy Gilbert, Shylo Johnson, Molly Selleck, Clara Mankowski, Lauren Greenberg, Yong Yang, James Ellison, Xianfu WU **Pág. 24**

WR7o - Rabies virus surveillance in wildlife: a pilot of inter-institutional cooperation within the One-Health Framework
María Fernanda Carreño, Hernán Darío Castiblanco-Martínez, Nicolas Reyes-Amaya, Julián Lozano-Florez, Alejandra Castaño-Rivera, Sebastián Cifuentes-Acevedo, Martha Gracia Romero, Sergio Yebrail Gomez-Rangel **Pág. 24**

DIAGNOSTIC

D1o" Improving wildlife rabies surveillance in Puerto Rico - Advances in Laboratory-Based Surveillance and the Potential Impact of Cryptic Bat Rabies Virus on the Island" Dr. Andrew Beron (CDC, USA)
Andrew Beron, Juan Jose De Jesus Oquendo, Miguel Maldonado Cedeño, Lillian Orciari, Crystal Gigante, Melissa Marzan Rodriguez, Sylvianette Luna Anavitate, Ryan Wallace **Pág. 24**

D2o - Diagnostic evaluation of the first canine-variant rabies cases in Canada in over 60 years
Christine Fehlner-Gardiner, Ruthann Duivesteyn, Marie-ev ST-Pierre, Cin Thang, Mingsong Kang **Pág. 24**

D3o - Direct rapid immunohistochemistry test in rabies virus isolates of domestic canids from the Maranhão and Mato Grosso do Sul states, Brazil
Fernanda Guedes, Samira Achkar, Sandriana Dos Ramos Silva, Elaine Raniero Fernandes, Willian De Oliveira Fahl, Keila Iamamoto Nogi, Iana Iamamoto Nogi **Pág. 25**

D4o - Automated detection of neutralising antibodies utilising a fluorescent rabies virus
Joan Manuel Amaya Cuesta, Guanghui WU, Hooman Goharriz, Anthony R Fooks, Lorraine Mcelhinney **Pág. 25**

D5o - Implementing rabies virus nanopore sequencing in Zambia
Rene Edgar Condori, Lynnfield Mooya, Masuzyo Ngoma, Edgar Kayesa, Samuel Yingst, Geoffrey Muuka, Linous Munsimbwe, Chilufa Mulenga, Ricky Chayza, LI Yu, George **Pág. 25**

D9o - Implementation of wooden applicators as an alternative in the dissection of the brain for the diagnosis of Rabies virus
Efren Jaramillo-Reyna, Alma Rosa Marroquín-Escamilla, María Mirthala Cavazos-Parra, Gloria Alejandra Jasso-De La Peña, Celia Alejandra García-Muñiz, Edgar Paolo Rodríguez-Vidales, Nidia Aréchiga-Ceballos **Pág. 26**

BATS RABIES

BR1o - Control of the transmitter "hematophagous bat" within the framework of the program for the prevention and control of Rabies of Wild Origin in Colombia
Diana Patricia Dallos Rodríguez, Andrés Felipe Osejo Varona, Edilberto Brito Sierra **Pág. 26**

BR8o - Situation of livestock rabies and the use of contact network to support hematophagous bat and rabies surveillance
Rocha, Felipe; Vigilato, Marco Antonio Natal; Molina-Flores, Baldomero; Dias, Ricardo Augusto; Cosivi, Ottorino **Pág. 26**

BR2o - Use of anticoagulants to control paralytic rabies and common vampire bat (Desmodus rotundus) populations: Historical analysis and perspectives
Laura Valentina Ávila Vargas Diego Soler-Tovar Luis E Escobar **Pág. 26**

BR3o - Molecular epidemiology and phylogeography of hematophagous bat Variant associated with human risk in Colombia
María Fernanda Carreño, Hernán Darío Castiblanco-Martínez, Martha Gracia-Romero, Carla Mavian, Sergio Yebrail Gomez-Rangel **Pág. 27**

BR4o - Epidemiological profile of the rabies virus transmitted by bats in the city of Fortaleza, Ceará
Mizael Moreira Sales, Klessiany Soares Rodrigues, Francisco Atualpa Soares Junior, Machado Teixeira Lima, Victor Hugo Vieira Rodrigues **Pág. 27**

BR5o - Bats Status in Coahuila, Mexico
María Susana Moreno Fernández **Pág. 27**

BR6o - Model for Surveillance, Prevention and Control of Bat-Transmitted Rabies in Urban Areas of Valle Del Cauca, Colombia
Constanza Núñez-Mejía and Lyda Osorio-Amaya **Pág. 27**

DOGS RABIES

DR2o - Advances to achieve Zero in 2030 in the Americas
Vigilato, Marco Antonio Natal, Rocha, Felipe; Molina-Flores, Baldomero; Cosivi, Ottorino **Pág. 28**

DR1o - Why rabies perpetuates: modelling predictors and barriers to dog vaccination decisions among dog owners in Nigeria
Philip Mshelbwala, Modupe Osinubi, Emmanuel Njoga, Terese Orum, J. Scott Weese, Nicholas Clark **Pág. 28**

DR3o - Alert level before rabies and population status of dogs and cats in the state of Puebla
Juan Manuel Balderas Torres, María Guadalupe Juárez Nava, Marcos Soriano Cruz **Pág. 28**

DR4o - The potential of unmanned aerial vehicles ("drones") for dog-mediated disease surveillance
Ricardo Castillo, Innovalab Antony Barja, Elvis W Diaz, Lizzie Ortiz-Cam, Innovalab Gabriel Carrasco **Pág. 28**

DR5o - Building local excellence to create sustainable and scalable rabies elimination programs
Frederic Lohr, Andrew D Gibson, Ryan M Wallace Alasdair King, Luke Gamble **Pág. 29**

HP14p - Community Participation in the Promotion and Prevention of Rabies in Peri-urban Areas of the Municipality of Ibagué
Samir Enrique Merino Olivella, Maria Del pilar Sanchez Bonilla, Ana Lorena Cifuentes **Pág. 29**

DR8o - Development of a Province-Wide Lay Vaccinator Program: Rabies Risk Management in Manitoba, Canada
Alexandra Erao **Pág. 29**

DR9o - Rabies virus exposure in dogs from brazilian indigenous communities by serological analysis
Matheus Lopes Ribeiro, Camila Michele Appolinario, Fernando Rodrigo Doline, Gisely Toledo Barone, Juliana Amorin Conselheiro, Bruna Leta Ribeiro, Alexander Welker Biondo, Jane Megid **Pág. 29**

DR10o - The dynamic impacts of mass dog vaccination on rabies incidence
Elaine Ferguson, Ahmed Lugelo, Anna Czupryna, BMachunde Bigambo, Jonathan Dushoff, Felix Lankester, Matthias Magoto, Lwitiko Sikana, Katie Hampson **Pág. 30**

DR11o - Case-report for rabies control and novel strategies for rabies prevention in a rural community in the state of Sonora, Mexico
Jorge Abril Landell, Gilberto Muñoz Durazo, Gabriela Del Carmen Nucamendi, Cervantes, Jose Luis Alomia Zegarra **Pág. 30**

PATHOLOGY AND INMUNOLOGY

PI1o - Experimental pathology in rabies: neurosciences approach
Orlando Torres-Fernández Biol **Pág. 30**

PI2o - The Milwaukee protocol for treatment of rabies
Rodney Willoughby **Pág. 31**

PI3o - Immune response against different variants of the rabies virus directs the course and clinical manifestations of the disease.
Elaine Raniero Fernandes, Bruna Stefanie Silvério Alves, Lilian Beserra Santos, Fernanda Guedes, Sandriana Dos Ramos Silva, Iana Suly Santos Katz, Samira Achkar, Maria Irma Seixas Duarte **Pág. 31**

PI4o - Loss of Calbindin Expression in mice inoculated with rabies virus
Julian Naizaque, Orlando Torres-Fernández **Pág. 31**

PI5o - Immunopathological changes in renal and urinary bladder tissues during experimental infection with a rabies virus antigenic variant 3
Livia Medeiros Neves Casseb, Sara De Souza Pereira, Cassia Nazare De Sousa Moraes, Erika Dayane Leal Rodrigues, Vinicius Pacheco Da Silva, Victor Gabriel Bastos Chaves, Roberta Nicole De Oliveira Mota, Jamille De nazare Magalhaes Dos Santos, Ranna Taynara Dos Reis Sousa, Adriana Maciel De Castro Cardoso Jaques **Pág. 31**

WEBINAR CATS

Web1 - RABIES IN FELIDS
CE RUPPRECHT **Pág. 32**

Web2 - Rabies in cats in Colombia
Luis Carlos Gómez **Pág. 32**

Web3 Rabies in Cats in Brazil
Silene Manrique-Rocha **Pág. 32**

Web4 Should we worry about rabies in cats? – A northern Americas perspective
Christine Fehlner-Gardiner **Pág. 32**

Web5 Epidemiology of cat rabies in Asia
Gyanendra Gongal & Tenzin Tenzin **Pág. 33**

Web8 - Rabies biologics for cat vaccination
Joanne Maki **Pág. 33**

POSTERS PRESENTATIONS
HUMAN RABIES AND PROPHYLAXIS

HP9p - Human rage in Oaxaca generates panic in the City of Puebla
Eduardo Carlos Bautista Lozano **Pág. 33**

HP10p - Indication and use of vaccine, serum and anti-rabies immunoglobulin in 2022 in the Federal District / Brazil
Manoel Fernando De Lima Correa Dieguez Barreiro, Moaravila De Jesus Moreira, Geila Múrcia, Meneguessi, Natalia Matias Dos Santos Dieguez Barreiro **Pág. 33**

HP11p - First Report of human rabies outbreak in an indigenous village -Minas Gerais' Brazil' 2022
Silene Manrique Rocha, Amanda Krummenauer, Ludmila Ferraz de Santana, Mariana Contijo, Magda Machado Saraiva Marcos Venicius Malveira de Lima, Nathalie Estima **Pág. 33**

HP13p - Traditional healers matter in One Health Approach to Rabies Control in Bangladesh
M Mujibur Rahaman, Delower Hossain, S M golam Kaisa **Pág. 34**

HP15p - Case Study about rabies transmitted to humans in Oaxaca
Oscar Ezequiel Blanco Esquivel, Margarita Garcia Luis **Pág. 34**

HP16p - Human Rabies in an Indigenous Community in Brazil: A One Health Approach
Amanda Krummenauer **Pág. 34**

EPIDEMIOLOGY AND SURVEILLANCE

ES10p - the history of rabies in Brazil
Luzia Helena Queiroz, Marilene Fernández De Almeida **Pág. 34**

ES11p - Survey of the genetic lineage of the rabies virus in samples from the municipality of Crateús - CE in the year 2017
Dennis Diderot Fontinele Catunda Melo, Larissa Leão Ferrer de Sousa, Francisco Esmaile De Sales Lima, Dilene Fontinele Catunda Melo **Pág. 35**

ES12p - Spatiotemporal analysis of bovine rabies and associated risk factors in Brazil's most highly incident states (2010-2019)
Holly Crompton, Cassiano Victäia, Marco Vigilato, Ricardo Dias, Ricardo Soares magalhaes **Pág. 35**

ES13p - Patterns of dog attack injuries and health-seeking delays in rural and urban communities of Zambia (2020 – 2021)
Humphrey Banda, Chitwambi Makungu, Leonard Ncholeka, Liywalii Mataa, Caesar Lubaba, Tensin Tensin **Pág. 35**

ES14p - Rabies in Canada – 2022
Christine Fehlner-Gardiner, Cin Thang, Mark Snodgrass, Zaheer IQBAL **Pág. 35**

ES15p - Evaluation of a new tool for case closure timely anti-rabies care in the Federal District, Brazil
Manoel Fernando De Lima Correa Dieguez Barreiro, Moaravila De Jesus Moreira, Natalia Matias Dos Santos Dieguez Barreiro, Geila MÚrcia Meneguessi, Edson Jorge Amorim De Paula **Pág. 36**

ES17p - Epidemiological Characterization of the Rabies Event in Valle del Cauca 2018-2021
Isabel Cristina Saltaren gallego, Erika Natalia Franco Hernández **Pág. 36**

ES18p - Epidemiological analysis of the accident caused by animal potentially transmitting the rabies virus in Fusagasugá, Cundinamarca, Colombia between 2020 and 2022
Daniela Fierro Cano, María Paula Vila Barreto, Diego Soler Tovar **Pág. 36**

ES19p - Behavior of aggressions by potentially rabies-transmitting animals in six localities of Bogotá during the period 2019-2020
Nestor Yaya Lancheros, Luis Joaquin Polo Teran **Pág. 36**

ES20p - A cross-sectional appraisal of knowledge, attitudes, and practices towards rabies: A preliminary approach in Colombia
Samir Enrique Merino Olivella, Sánchez Bonilla, María Del Pilar, Daniel Camilo, Aguirre Acevedo, Nathalia María del Pilar Correa Valencia **Pág. 37**

ES21p - Laboratory surveillance of rabies virus associated with human risk between 2010-2023
María Fernanda Carreño, Hernán Darío Castiblanco-Martínez, Martha Gracia-Romera, Sergio Yebrail Gómez-Rangel **Pág. 37**

WILDLIFE RABIES CONTROL

WR8p - Oral rabies vaccine bait uptake by target and non-target species in developed areas of Tennessee, 2021-2022
Are Berentsen, Michael Darity, Samuel Dowlen, Erin Patrick, Richard Chipman, Amy Gilbert **Pág. 37**

WR9P - Knowledge and attitudes related to the risk of exposure to rabies transmitted by wild canids in the state of Ceará, Northeastern Brazil
Silene Manrique Rocha, Vitor Salvador Picï gon‖Ives, Alessandro Pecego Martins Romano, Ana Lourdes Arrais Mota **Pág. 37**

WR10p - Multidisciplinary approach with a One Health approach for the Prevention and Control of Human Rabies and in dogs and cats in the State of Nuevo León
Alejandra Marines Ramírez **Pág. 38**

WR12p - Evaluation of contingency actions to control the spread of raccoon rabies virus in Ohio and Virginia, USA
Amy Gilbert, Amy Davis, Richard Chipman, Kathleen Nelson, Betsy Haley, Jordona Kirby, Xiaoyue MA, Ryan Wallace **Pág. 38**

WR14p - Cost Effectiveness Analysis of the Texas Wildlife Rabies Border Maintenance Zone
Stephanie Shwiff, Glenn Swanson, Susan Rollo, Kathy Parker, Steven Shwiff, Mike Bodenchuk, Joanne Maki **Pág. 38**

WR15p - Estimation of the population of Cerdocyon thous and prevalence of the rabies virus in the municipalities of Zapayan and el Piñon in the department of Magdalena
Gualberto Naranjo-Maury, Julieth Prieto Rodriguez,EndyJ Gonzales Pareja, Jose D. Morales Delacruz **Pág. 38**

WR16p - Rabies in wild canids and the cerdocyon thous variant in Northeastern Brazil, spatial distribution and epidemiologic importance
Silene Manrique Rocha, Ana Lourdes Arrais De Alencar Mota, Alessandro Pecego Martins Romano, Vitor Salvador Picï Gonzalves **Pág. 39**

WR17p - Rabies serologic survey in maned wolves, an endangered wild canid species in Brazil
Matheus Lopes Ribeiro, Camila Michele Appolinario, Bruna Leta devid Ribeiro, Gisely Toledo Barone Divis, Joares Adenilson May-Junior, Barbara Do couto peret Dias, Jane Megid **Pág. 39**

WR18p - Rabies Risk Management in Churchill, Canada: A One Health Collaborative Approach
Alexandra Jerao **Pág. 39**

WR19p - Identification of variables associated to rabies virus infection transmitted by wildlife to domestic cats in the state of Yucatan
Aurea M. Salgado-Cardoso[1], José Ignacio Olave-Leyva[2], Ivonne Morales, Alvaro Aguilar-Setién[5], Gabriel García-Rodríguez[6], Hugo López-Gatell Ramírez[7], Irma López-Martínez[1], Nidia Aréchiga Ceballos **Pág. 40**

DIAGNOSTIC

D6p - Update: Further optimization of pan-lyssavirus LN34 assay for rabies Diagnosis
Yu LI, Crystal Gigante, Vaughn Wicker, Kimberly Wilkins, Hui Zhao, Lillian Orciari, Rene Condori, Pamela Yager **Pág. 40**

D7p - Proficiency tests (PT) for the detection of the rabies virus by Direct Immunofluorescence (DFA) in the Americas 2017-2022. CENASA-Mexico, OMSA Reference Laboratory for Rabies
Israel Nicolas Reyes, Carlos Enrique Jasso Villazul, Georgina Robles Pesina **Pág. 40**

D8p - Evaluation of the Bionote LFD for Rabies Diagnosis Using a Modified Protocol
Orciari LA, Hartloge C, Yager PA, Bonaparte, S, Patel P, Seiders M, Silas, K, Cedeño MM, Ramos RF, Messenger S, Lopez R, Preas C, Tamnanchit H, Chow A, Mendoza S, Gigante C, Wicker V, Condori E, Beckmen KB, Dreese L, Lieske C, Campbell K, Geoff M, Vogt C, Liefer A, Gunkel M, Mason A, Ray M, Buch S, Hovis L, Wingerter LM, Schwarzkopf KL, Fujaga DS[0], Satheshkumar PS, Wallace R **Pág. 40**

D10p - Diagnosis of Rabies Wild Origin. In National Veterinary Diagnostic Laboratory LNDV ICA. 2020-2022
Juan Carlos Ospina Chirivi[1], Fabiola Rodríguez Arévalo **Pág. 41**

BATS RABIES

BR7p - A bibliometric survey of the common vampire bat prey
Juliana Montufar Patiño, Diego Soler Tovar, Luis Escobar **Pág. 41**

BR8p- Active surveillance of rabies of wild origin in the Departments of Cauca and Vaupés: Focus on bats
Henry Rubio Urrea, Andrés Felipe Osejo Varona, Edilberto Brito Sierra **Pág. 41**

DOG RABIES

DR12p - A mathematical framework to optimize placement of dog rabies vaccination campaigns: lessons for future pandemics
Ricardo Castillo, Sherrie XIE, Brinkley Raynor Bellotti, Elvis W. Diaz, Aris Saxena, Amparo M Toledo, Gian Franco Condori, Maria Rieders, Bhaswar B Bhattacharya, Michael Z Levy **Pág. 41**

DR13p - Canine rabies control in Brazil: past and present
Silene Manrique Rocha, Fernanda Bordalo, Francisco Edilson Ferreira De Lima Junior, Nathalie Estima **Pág. 42**

DR14p - The use of the KoboToolbox platform as a capture mask for attacks by any species for a better analysis of the information, in the State of Chiapas, Mexico
Jordan Edgardo BERMúDez Casillas **Pág. 42**

DR16p - Evolution in municipal participation for the prevention and control of rabies in humans and in dogs and cats
Alfredo Mejia Solis **Pág. 42**

DR17p - Anti-rabies vaccination of dogs and cats as a blocking measure against a rabies outbreak in the indigenous village of Pradinho, Bertópolis - MG, Brazil
Dilceu Silveira Tolentino Junior **Pág. 42**

PATHOLOGY AND INMUNOLOGY

PI6p - Analysis of the antigenic and immunogenic properties of the native rabies virus glycoprotein purified by Lens culinaris lectin affinity chromatography
Sandriana Ramos Silva, Cintia Pinto Da Silva, Iamamoto Nogi, Elaine Raniero Fernandes, Fernanda Guedes, Iana Suly Santos Katz, Karina Ribeiro Da Silva **Pág. 43**

PI7p - ASTROGIAL REACTION IN THE CEREBRAL CORTEX OF RABIES-INFECTED MICE
Gerardo Santamaria Romero, Andrea Del pilar Hurtado Cruz, Orlando Torres-Fernández **Pág. 43**

PI8p - DENDRITIC PATHOLOGY AND MAP2 OVEREXPRESSION IN THE CEREBELLUM OF RABIES-INFECTED MICE
María Paula Morales Arce, Andrís Obdulio Porras Rodríguez, Gerardo Santamaría Romero Orlando Torres-Fernández **Pág. 43**

Proceedings Rita Colombia 2023

INAUGURAL CONFERENCE

IS5o - The Global Strategic Plan to end human deaths from dog-mediated rabies by 2030

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1 World Organization of Animal Health - France

The United Against Rabies Forum was launched by the FAO, WHO and WOAH 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'. This stakeholder network now encompasses more than 60 organisations representing international and regional organisations, national governments, NGOs, academic and research institutions and civil society organisations. Key priorities of the United Against Rabies Forum during 2023 included engaging rabies-endemic countries and supporting the development and implementation of national strategic plans; engagement of local authorities and communities to prioritise rabies elimination at the local level; working with academic and industry partners to support implementation of rabies strategies; promoting improved surveillance, data sharing, and data reporting; and supporting advocacy and resource mobilisation, including the promotion of access to human post exposure prophylaxis. The United Against Rabies Forum is now coming to the end of a third year, and continues to evolve to meet the needs of rabies endemic countries, while connecting these countries with stakeholders and experts that can help accelerate progress towards Zero by 30.

IS4o - Colombian experience in rabies control and prevention

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Rabies is a zoonotic disease caused by the Lyssavirus virus and is transmitted mainly by the bite of infected animals. In Colombia, this disease is considered a public health priority because of its high lethality, so the Ministry of Health and Social Protection and the health and environmental authorities are developing strategies for the prevention, detection and control of rabies in its urban (dog) and wild (bat) transmission cycle.

The Ministry of Health and Social Protection will present the behavior of human and animal rabies cases in the period between 2004 and 2022. For this purpose, data from the National Health Institute - INS and the Colombian Agricultural Institute - ICA were compiled, disaggregating each case by territory of occurrence (department and municipality), animal species affected and variant or lineage identified.

In addition, the actions adopted by the country for the prevention and control of rabies will be presented. This includes the presentation and analysis of the guidelines and orientations implemented at the sectoral level and intersectoral management at the national and local levels, including the estimation of the dog and cat population by municipality, district, municipality, strategies for rabies vaccination of dogs and cats and primary production animals, pre- and post-exposure immunization of humans, active surveillance of rabies in animals, surveillance and follow-up of reported cases of rabies, mechanisms for coordination and information flow between the different actors, surveillance and control of establishments with rabies cases, surveillance and follow-up of reported cases of rabies, mechanisms for coordination and information flow between the different actors, surveillance and control of veterinary establishments to verify the conditions for handling the animal biologic, coordination with veterinarians and zootechnical veterinarians for suspicion, reporting of animals suspected of rabies and reporting of rabies vaccination of dogs and cats.

Based on this analysis, the country's challenges to achieve the goal of eliminating dog-mediated human rabies and controlling human rabies of wild origin, as part of the commitment of the countries of the Americas promoted by the Pan American Health Organization - PAHO, will be discussed.

Key words: rabies guidelines, vaccination, surveillance, pre-post exposure immunization, challenges

IS3o - Colombian experience in prevention and control of rabies from the agricultural sector

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Introduction: The National Program for the prevention and control of Rabies of Wild Origin is framed in Decree 1071 of 2015 and ICA Resolution 2602 of 2003, through which rabies is considered a disease of public health importance and establishes the sanitary measures of the disease in production animals. The country has made great efforts to control rabies of wild origin because, due to its geographical location, more than 80% of the National Territory has the presence of hematophagous bats (vampires), which are the main vectors and transmitters of this virus. The presence of the vector in Colombia doesn't mean that there is a high incidence of outbreaks of this zoonosis. Since 2021, immunization against rabies in risk areas has been linked to preventive measures; This immunization is part of the first cycle of vaccination against foot-and-mouth disease using a bivalent vaccine against foot-and-mouth disease and rabies. This vaccination was determined from the historical analysis of outbreaks of the last 12 years (2009 to 2020) and with the support of a study on the risk of rabies of wild origin in Colombia carried out by the Rural Agricultural Planning Unit - UPRA within the framework of a technical cooperation agreement with the Colombian Agricultural Institute - ICA. **Objective:** Reduce and/or eliminate wild rabies in Colombia. **Materials and Methods:** The strategies implemented within the national program established by the ICA are based on notification and care of animals with neurological signs diagnosis of the disease, differential diagnosis characterization of strains, control of populations of hematophagous bats infected associated with confirmed outbreak of the disease, review of vampire migratory routes, location of refuges, epidemiological surveillance, vaccination of bovines and buffaloes in risk areas, training education and awareness as well as interaction with environmental and public health entities for the control and monitoring of outbreaks. **Results**: Between the years 2010 to 2014 there was a continuous increase in outbreaks per year; However, from then on there has been a substantial decrease with a minimum occurrence in 2023. On average between the years 2010 to 2020, an average of 139 outbreaks occurred per year, while between 2021 to 2023, an average of 37 have occurred outbreaks per year, with 2023 being the year with the lowest number presented with only 18 outbreaks (10 catle, 1Buffaloe and 7 equines). The factors to which these results are attributed include the timely attention to notifications and the high populations of vaccinated cattle and buffaloes in the last 3 years.In 2023, 9,741,581 cattle and buffaloes were vaccinated in 157 municipalities at risk of the disease in 18 departments of the country, obtaining a vaccination coverage of 94.90%.The ICA continues to study the relationship between obtaining high vaccination coverage in risk areas versus the number of outbreaks that occur. **Conclusion:**The occurrence of wild rabies outbreaks in Colombia has been in significant decline over the years, mainly attributed to surveillance and vaccination actions against the disease in identified risk areas.

Key words: Rabies, surveillance, vaccination, neurological, notification

IS2o - A validated sandwich ELISA immunoassay for the quantitation of rabies glycoprotein as a tool for vaccine formulation and its correlation with NIH potency test

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1 VECOL S.A.

Rabies has a fatality rate of almost 100% in humans and animals alike and remains a worldwide threat. Vaccination, especially of domestic animals, is a cornerstone of rabies control efforts. Most manufacturers of rabies vaccines quantify rabies glycoprotein, as a critical marker in the formulation of finished products. The glycoprotein, which is prominently present on the surface of the rabies virus, serves as a crucial antigen in developing effective vaccines against this deadly disease. Typically, glycoprotein quantification involves the use of non-validated immunoassays, which exhibit a limited correlation with the NIH potency test results. The goal of this study was to validate and implement an immunoassay that accurately measures the virus glycoprotein, while also demonstrating a robust correlation with the NIH potency test. This initiative strives to improve production-process efficiency by implementing enhanced quantification methods. For the sandwich ELISA design, the rabies glycoprotein was purified through a two-step liquid chromatography from a batch of antigens produced in VECOL S.A. Subsequently, a polyclonal antibody was generated by using our purified glycoprotein. Incorporating this glycoprotein in the ELISA was crucial to obtaining high specificity and a good correlation with the NIH potency test. The validation process of the ELISA encompassed the assessment of several key parameters, including stability, selectivity, linearity, precision, repeatability, limit of quantitation, and specificity. Following the validation and implementation of this technique, the correlation with the NIH potency test was evaluated using Cohen's Kappa coefficient. Despite the well-documented high variability in the NIH results, this study was able to demonstrate a positive correlation with coefficient of 0.4211 with the quantification of the glycoprotein. This technique has been incorporated into the quality control program of the rabies vaccine in VECOL, with a positive impact on production efficiency and yields.

Key words: Rabies virus, Glycoprotein, vaccine potency, immunoassay, positive correlation.

IS1o - History of rabies in Colombia: the time for an intentional One health approach is now

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Before the arrival of the Spanish conquistadors, it is likely that rabies virus was only present in bats in the New World. Research on canine rabies and human rabies vaccination in Colombia began at the National Institute of Health in the second decade of the 20th century. The National Veterinary School at The National University of Colombia, also contributed to the diagnosis of wildlife rabies, canine rabies and canine rabies vaccination campaigns. The progress in rabies research, rabies vaccination campaigns and rabies diagnosis were done with the support of international cooperation organizations from Europe but especially from the United States during the first 50 years of the 20th Century. The following years, important institutions were funded: the Colombian Agricultural Institute (ICA) to do animal rabies diagnosis and the Colombian Vaccine Production (VECOL) supporting rabies animal vaccines production. The Colombian leadership on dog rabies vaccination campaigns was recognized in The Americas Region, since controlling rabies transmitted by dogs took care of around 90% of human rabies cases the country had before 2000. Currently two epidemiological cycles are of great importance for the viral transmission in Colombia: from 2006 the Magdalena region accounts for 77% of the total reported animal cases with V1 variant (dogs, cats and foxes) plus all the bovine and equine cases (V3,V4 variant), since 1999, forty three people have died of rabies in Colombia; 8 by dogs (the last case in 2007), 21 deaths by direct contact with bats and 14 deaths due to direct contact with unvaccinated cats, which were infected by bats, the current trend since 2008. In 1980, the Instituto Colombiano Agropecuario (ICA) started a disease control program of bovine rabies considering four main activities: vaccination; vector control; tracking of outbreaks; and characterization of risk zones. Although the road for true rabies elimination in Colombia is still long, there has never been a better time to update Colombian health policies and implement control tools towards the One Health approach than now. Colombia will be able to prevent and control human rabies by collaborating with multi-sectoral investment to sustain prevention and control, integrating many stakeholders such as Academia, private sector, NGO`s and public health support within the communities at highest risk which historically have been neglected. We present a proposal to create the national One Health Strategic Action Plan to support the operationalization of a cross-sectoral integrated zoonoses control programme in Colombia.

Key words: Rabies, History, Colombia, One Health, Leadership

HUMAN RABIES AND PROPHYLAXIS

HP2o - Clinical Impact of Rabies: Importance of Evidence-Based Guidelines

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Human rabies continues to be a significant public health problem in some developing countries. This viral zoonotic disease may causes progressive and fatal inflammation of the brain and spinal cord. Clinically, it has two forms: Encephalitic (Furious) rabies – characterized by hyperactivity and hallucinations. Paralytic rabies – characterized by paralysis and coma. More on, this is a vaccine-preventable disease. Nevertheless, rabies still kills tens of thousands of people each year. Of these cases, approximately 99% are acquired from the bite of an infected dog. Rabies is estimated to cause approximately 60,000 human deaths annually in over 150 countries, with 95% of cases occurring in Africa and Asia. But also, recently still in Latin America, this is a problem, especially in countries such as Venezuela, Bolivia, Haiti and Peru. the international community has called for the world to be canine rabies-free by 2030 (Zero by 30); specifically, no indigenously acquired dog-mediated rabies cases among humans are to be achieved by the end of this decade. The Global Strategic Plan to End Human Deaths from Dog-mediated Rabies by 2030, launched in June 2018, targets the disease at the dog reservoir and aligns efforts to prevent human rabies and strengthen animal and human health systems. By implementing the Strategic Plan, affected countries will move a step closer to Sustainable Development Goal (SDG) 3.3, "By 2030, end the epidemics of neglected tropical diseases", and make progress towards achieving SDG 3.8 on universal health coverage. As with all zoonotic diseases, a One human, animal and environmental health (One Health) approach with cross-continental multidisciplinary collaborations will be central to achieving the aims of this strategy. Evidence-based guidelines play a vital role in improving rabies management. They provide a structured, well-informed, and standardized approach to diagnosis, treatment, and prevention, which is especially critical in regions like Latin America, where infectious diseases like rabies still pose a significant public health threat. Our dedication to scientific research and evidence guidance is a valuable contribution to this cause, and the clinical scientific societies (e.g. SLAMVI, ACIN) are available to work together with colleagues from other areas: One Health approach is key for that.

Key words: Rabies, human disease, control, evidence-based guidelines, Latin America.

HP1o - clinical approach to rabies under one health lens

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Rabies efforts must comprehensively consider the need for a multidisciplinary OneHealth response at multiple levels, allowing for a better understanding of the complex interactions between human and animal health with the shared environment, not just the integration of actions between the WHO, the World Health OrganizationAnimal Health (WOAH/OIE) and the Food and Agriculture Organization of the United Nations (FAO), which set the goal of eliminating human rabies transmitted by dogs globally by 2030 but at the community level by multidisciplinary teams in the control and prevention of diseases in humans and animals. This OneHealth approach is essential to strengthen collaboration, communication, capacity development and coordination equally across all sectors responsible for addressing health issues at the human-animal-environment interface. Therefore, engagement and multi-sectoral approach are essential under the umbrella of OneHealth collaboration, including community education, awareness program and vaccination campaigns.. Unfortunately, in some countries, for example Panama and Venezuela, mandatory rabies vaccination is not carried out regularly, although in these territories studies on rabies have also shown its results.

Strategies to achieve "Zero by 30" condense social changes in three objectives: Effectively use vaccines, medicines, tools and technologies; Generate, innovate and measure impact, through authentic sustainable collaborative partnerships between different scientific and more sophisticated technical disciplines and to maintain commitment and resources, For example, it is possible to interrupt transmission through mass vaccination of dogs, However, given that the cornerstone of rabies eradication is mass vaccination campaigns in dogs, these should be reinforced by verifying the seroconversion of animals. Any vaccination failure or seroconversion should be investigated to detect possible errors in the protocol. Besides, Immediate and thorough washing of the wound with soap and water after contact with an animal suspected of rabies is crucial and can save lives.

Key words: Rabies, OneHealth, Multisector, Clinical, Approach

HP3o - Human rabies risks following exposure: Development of a rabies homunculus using an Artificial Intelligence tool

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1 Rabies Free World

Introduction: The risk of rabies transmission to humans from an infected animal depends on a number of factors. An important parameter is the bite location, which relates to the neuroanatomy of the patient, including nerve distribution and density. Given the importance of rabies post-exposure prophylaxis (PEP), particularly for high risk exposures, we developed a rabies homunculus to approximate risk of disease development, and inform PEP implementation. Methods: We reviewed published data on human rabies in regard to bite location. With the help of Artificial Intelligence (AI) – we transformed this into approximate body size parts of the homunculus. **Results:** Literature review showed risk of progression to rabies following exposure exhibited some variance. In general, these risks were approximately: bite to head and/or neck 50 to 80%; bite to fingers and/or hand 15 to 40%; and bite to foot and/or lower extremity 3 to 10%. Output from the Dream Studio AI tool and a human drawing conformed to these estimates. Discussion: Rare cases of PEP failure have occurred in severe bites to the head and neck. A recently reported failure of PEP followed a bat bite to the thumb. Variables for development of disease after exposure include number of wounds, wound severity, depth and anatomical factors, and proximity to highly innervated areas. Additional factors also include viral wound contamination, virulence, and other clinical aspects. A graphical representation of rabies risk depending on bite location may help emphasize the urgency and importance of rabies PEP. **Conclusion:** The development of a rabies homunculus informs clinicians, public health officials and others involved in rabies PEP. It could also support practice and policy decisions related to the newly proposed Category IV rabies exposure classification. Innovative AI tools and applications offer new hope for advancement in the age old fight against rabies.

Key words: human rabies, post exposure prophylaxis, rabies exposure, rabies, rabies vaccine

HP4o - Comparison of International Rabies Antibody Reference Standards

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Introduction: Standard rabies immune globulin (SRIG) promote uniform potency measurement of RIG products used for human prophylaxis, vaccine response, and disease diagnosis in IU/mL. Currently available SRIGs are: from human source, 3rd WHO and EDQM; and canine source WOAH. Routine evaluation of the reference standard in use against a recognized international SRIG allows for monitoring of drifts and shifts. Consistent and accurate assignment of IU/mL values for rabies biologicals and immune response monitoring is reliant on the potency of the reference standard used in the immunoassay. **Objective:** Previous studies identified loss of potency in the 1st WHO SRIG. This study evaluates the currently available SRIGs to establish baseline relationship for future monitoring. **Materials/Methods:** Each SRIG were assessed by serum neutralization (SN) and indirect ELISA. Titers and standardized results (derived by comparison against each SRIG) were compared for potency and seroconversion determination. **Results:** Average titer values by two SN methods demonstrated a consistent relationship between SRIGs which differed from the ELISA results. A trend toward higher IU/mL values was noted when the 3rd WHO was used as the SRIG to obtain the SN result values; closest agreement was found between the 3rd WHO and EDQM derived IU/mL values in comparison to WOAH derived values. The variation in SN titer values between SRIGs was greater than between replicates of each per method. The WOAH samples ELISA results matched closest to the expected potency, while the EDQM and 3rd WHO samples were underestimated. Conclusions: The potential for obtaining incongruent measurements with use of different SRIGs in different methods was identified. Tracking of antibody response to rabies vaccines over time can be affected by changes in laboratory methods, and performance standards including international reference serum. The potency relationship between different SRIGs is a consideration in the interpretation and use of rabies serology results.

Key words: Immunoassay, Rabies Antibody, Quality Control, Standardization, International Reference Serum

HP5o - Cultural practices related to aggressions by potentially rabies-transmitting animals in Colombia. 2007 – 2009

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Introduction: Animal aggressions are considered a medical emergency, so that the attacked persons should immediately consult the medical service to assess the magnitude of the wound and the possible exposure to the rabies virus. In Colombia, there are cultural practices and imaginaries surrounding the care of animal bites by communities and health personnel. These practices constitute a barrier to the immediate care of the attacked persons. In some communities, the notion of the risk of disease transmission through a bite is unknown or invisible. Objective. To understand and interpret the practices and cultural imaginaries of the community associated with the care of bites caused by a domestic or wild animal through surveys, stories and exchanges of knowledge. Methodology. The field work was carried out during epidemiological monitoring during the investigations of human rabies outbreaks and follow-up of animal bites that occurred between 2007 and 2009. The information was obtained through the collection of field notes, surveys, talks, stories, interviews and exchange of knowledge. Results. It was identified that one of the cultural practices most used by the communities in the face of animal aggressions is the use of lemon to treat the wound and avoid infection. However, none of the cases consulted a doctor. With respect to the professional medical service, the use of the Milwaukee protocol was the most applied practice, without considering the factors established in the care protocols to define exposure to the rabies virus. Conclusions. It is necessary to promote training and updating of risk knowledge in communities affected by aggressions and contact with domestic and wild animals, as well as to update health professionals in the approach to the protocol and the mandatory rabies management guidelines and rabies protocol.

Key words: rabies, Biting, cultural practices, knowledge Exchange, imaginaries

HP6o - Development of SYN023 Anti-Rabies mAb Cocktail

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1 Synermore Biologics

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. Updated spectrum of neutralization studies and epitope mapping analyses will be discussed. 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 well tolerated when administered alone or with rabies vaccine in subjects with rabies exposure as well as healthy subjects and has a favorable safety profile. The safety profile was similar to that of the currently approved HRIG in the US. Overall, the incidence of serious TEAEs throughout the studies was low (<5.0%) and similar between the SYN023 and HRIG groups. No TEAE led to study withdrawal in subjects treated with SYN023. The most common solicited TEAEs with SYN023 and HRIG were injection site swelling, injection site pain, headache, and injection site erythema. A higher incidence of these TEAEs was noted in subjects treated with HRIG than in subjects treated with SYN023. Across 6 clinical trials, RVNA appeared to be adequate at the 0.3 mg/kg dose level to rapidly establish RVNA of ≥0.5 IU/mL in the rabies-exposed person. The primary endpoint for the ISE was the GMC of the RVNA on Study Day 8 in the FAS (SYN023, N=978; HRIG, N=469). The GMC ratio of RVNA (SYN023 vs HRIG) on Study Day 8 was 13.977 (97.5% CI: 11.887, infinity; P<0.0001); SYN023 was considered superior to HRIG with respect to GMC of RVNA on Study Day 8, as the lower bound of the 97.5% CI was above the prespecified margin 1.2. The immune response (RVNA ≥0.5 IU/mL) rate ratio (SYN023 vs HRIG) was 0.99 (95% CI: 0.96, 1.01; P<0.0001); SYN023 was considered noninferior to HRIG with respect to immune response rates on Study Day 99, as the lower bound of the 95% CI was above the prespecified margin 0.9. There were no deaths, serious adverse events, or AEs leading to study discontinuation up to 365 days after dosing.

Key words: Anti-rabies monoclonal antibody cocktail, Neutralization spectrum, Integrated Summary of Safety, Phase 3 clinical trial, Category III rabies patients

HP7o - Rabies and Dog Bite Prevention Training in Southwestern Kenya: Collaborating with Local Communities

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1 BI
2 MNC Dog Project
3 GARC

Introduction Rabies is transmitted to humans almost exclusively by bites from domestic dogs in Africa and Asia. Thousands of people die each year from this preventable disease. Children, given their smaller stature and increased likelihood to play with dogs, are disproportionately affected by rabies, which is always fatal after the onset of symptoms. Boehringer Ingelheim Stop Rabies program has begun supporting the Mara North Conservancy Dog Project to provide rabies and dog bite education to school children in rural Kenya. Objective The aim of the initiative is to increase community awareness and knowledge of rabies, responsible dog ownership, dog behavior, dog bite prevention, and dog bite treatment, by educating school children and their family members. Materials and Methods Two veterinary professionals are contracted by Boehringer Ingelheim Stop Rabies to give interactive trainings to school children aged 5-16 using a rabies and dog bite prevention booklet from Global Alliance for Rabies Control (GARC) and a colored pencil for each child to take home. The instructors travel by motorbike to rural primary schools to give hour-long classroom training sessions. Results One veterinarian and one veterinary technician have delivered over 100 trainings to more than 8000 children in almost 60 schools in Narok and Bomet counties during the initial period of six months. Assuming the children passed the information to their families, we estimate that more than 40,000 people have been educated about rabies and dog bite prevention in these rural, underserved communities. Conclusions Given the expense and frequent lack of access to post-exposure prophylaxis in rural southwestern Kenya, increasing awareness of rabies and knowledge about dog bite prevention may be a more cost-effective way to prevent human rabies deaths. By providing educational materials for children to share with their families, programs like this may reach larger community audiences beyond the classroom.

Key words: rabies, dog bite, bite prevention, Global Alliance for Rabies Control, Kenya

- Prophylactic mass immunization measures in response to the rabies outbreak in indigenous children from Pradinho, Bertópolis, MG, Brasil, 2022

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Introduction: In the Pradinho rabies outbreak, the most cost-effective measures aimed at preventing and controlling rabies in humans were pre- and post-exposure prophylaxis implemented in susceptible indigenous people. **Objective:** The purpose of the prophylactic treatment used was to interrupt the epidemiological chain of transmission of the disease, thus avoiding the morbidity, mortality and lethality of this morbid condition. **Materials and methods:** Availability of the pre- and post-exposure scheme for all contacts of the 4 cases, with four doses of anti-rabies vaccine (0, 3, 7 and 14 days) and immunoglobulin, in addition to establishing the pre-exposure prophylactic scheme (0 and 7 days) for the entire Maxakali population of the five different groups, due to the intense contact with bats by all life cycles, mainly children and adolescents. **Results:** 100% of contact residents in the Pradinho Community were immunized (43 people) who received the doses on days 0, 3 and 7. Of these 43, only 38 (88.0%) took the dose on day 14. Regarding the 37 contacts related to the administration of human anti-rabies serum and/or human rabies immunoglobulin, only 25 (68.0%) received the dose. For the instituted pre-exposure prophylaxis, 99.8% of the population (2,500 individuals) was immunized with respect to the dose on day 0; for individuals who received the dose on day 7, the coverage reached 98.2% among the 2,500 eligible individuals living in the municipalities of Bertópolis, Santa Helena de Minas, Ladainha and Teófilo Otoni. **Conclusion:** Both vaccination schemes employed had satisfactory coverage and contributed significantly to the prevention and control of new cases.

Key words: Human rabies, human rabies vaccine, Pre-exposure prophylaxis, Post-exposure prophylaxis, immunoglobulin

HP8o - Training in the appropriate approach in the first level of care of the patient exposed to the rabies virus by an animal susceptible to suffering from this zoonosis aimed at doctors and nurses in social service

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Introduction: Although Mexico was declared a country free of rabies transmitted by dog bites, in the event of an attack by this species, epidemiological surveillance must be carried out and post-exposure prophylaxis applied if necessary. It is essential to clarify that other species transmit the rabies virus. That is why proper training of doctors and nurses in social services is needed to manage this disease and avoid deaths. The social service was established in Mexico in 1936 to serve the population. Additionally, doctors and nurses acquire the knowledge, experience, skills, aptitudes, and values to provide high-quality medical care in their professional lives. Objectives: Assist in training and disseminating knowledge of rabies among doctors and nurses in social services to provide proper care for patients potentially exposed to the rabies virus. Materials: Seminars, exams, and workshops. Methods: Since 2020, all the doctors and nurses in the social service of the Mazzotti Health Center have been trained. In 2023, the necessary actions were taken to prepare all those of the Iztacalco Health Jurisdiction. **Results:** Through the courses and workshops implemented, it was possible to train 157 doctors and nurses in the Iztacalco Health Jurisdiction social service. We obtained an initial evaluation, yielding an average of 1.9 points over 10, and in the post-training assessment, an average of 8.7 was obtained. The training included a description and the relevance of the Rabies in the Americas Conference and the additional training of 171 students from the second and third year of medical and nursing careers. Conclusions: With the training implemented, it was possible to contribute to deepening the knowledge of rabies and improve the management and care of the patients exposed to the rabies virus.

Key words: Rabies, training, doctors , nurses, social service

EPIDEMIOLOGY AND SURVEILLANCE

ES1o - Rabies epidemiology in Americas and the Caribbean

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Rabies, an age-old and incurable viral disease, is controlled through timely vaccination, which not only protects individuals from exposure but also exemplifies the effectiveness of public health systems. This benchmark began with the development of the first human rabies vaccine by Louis Pasteur in 1885. Rabies, a zoonotic disease affecting all mammals, spreads primarily through saliva via infected animal bites, manifesting initially with localized symptoms and progressing to severe neurological and cardiorespiratory distress. Urban settings worldwide continue to grapple with canine rabies as a prominent cause of human infections.

However, the Americas have made substantial strides in canine rabies control, thanks to robust Rabies Control Programs and support from the Pan American Foot-and-Mouth Disease Center and Veterinary Public Health of the Pan American Health Organization/World Health Organization. As canine rabies recedes in the region, other transmission cycles gain prominence, including bats, particularly hematophagous bats like Desmodus rotundus, transmitting rabies to domestic herbivores and vulnerable populations in the Amazon, and various wild animal species contributing to rabies transmission. This comprehensive analysis sheds light on the evolving landscape of rabies in the Americas.

Over five decades, the SIRVERA database has amassed 103,219 notifications, comprising 58,864 notifications related to 802,753 animal cases, 2,192 notifications for 7,572 human cases, 42,086 notifications with 1,128,852 negative test results for rabies samples from both animals and humans, and 77 notifications detailing annual public health actions.

From 2017 to 2022, 659,194 animal samples underwent rabies diagnosis in the Americas, revealing a declining trend year by year. The proportion of positive cases during this period was 5.6%, varying across animal categories, with dogs, domestic herbivores, and wild animals presenting distinct surveillance patterns.

The COVID-19 pandemic and data collection timelines led to a decline in sample processing, notably in 2018 and 2019, with nearly 20% fewer samples analyzed compared to 2017.

During this period, the Americas reported 104 human rabies cases, with 49 attributed to dog bites (including two imported cases from the United States) and 55 to other animals. A notable epidemiological shift is observed, with dog-related human rabies cases now limited to a few countries (Bolivia, Cuba, Guatemala, Haiti, and the Dominican Republic), while wild animal-related cases span from north to south in the continent.

Cats, the third most significant animal species transmitting rabies to humans, accounted for 12 cases over six years in 13 countries, with 101,698 cat samples processed and an average 1.2% positivity rate.

From 2017 to 2022, 160,876 bat samples underwent rabies diagnosis, revealing an average positivity rate of 6.3%, with differences observed between non-hematophagous and hematophagous bats.

As many countries in the Americas approach canine rabies elimination, the focus shifts towards validating rabies-free regions concerning human transmission by dogs. Notably, domestic dog-related exposures remain manageable due to symptom monitoring before initiating post-exposure prophylaxis. However, this approach is not applicable to cases involving domestic herbivores, non-domesticated dogs and cats, or wild animals, necessitating comprehensive surveillance, research, and preventive measures to address evolving rabies challenges in the Americas.

Key words: integrated surveillance, prevention, barriers, The Americas, strenghts

ES3o - Variant typing of rabies virus by sequencing the LN34 amplicon: a cost-efficient method for genetic typing

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Antigenic and genetic variant typing are invaluable tools used to identify circulating variants of rabies virus (RABV), monitor elimination efforts, track outbreaks, and illuminate sylvatic cycles of transmission. For many years, the direct fluorescent antibody (DFA) test has been the standard for rabies diagnostic testing due to its reliability and standardization of practices. Antigenic typing using monoclonal antibodies (MAbs) is easy to use alongside the DFA test and offers low cost, quick variant results. However, the performance and resolution of antigenic typing depend on the MAbs used, which take time to develop, must cover known circulating RABV variants, and frequently face shortages in supply. By comparison, genetic typing can generate more detailed data of RABV variants and provides valuable phylogenetic information; however, the resolution of genetic typing relies on the size and genetic diversity in the target region. In this study we build upon previous work that demonstrates the use of the pan-lyssavirus LN34 Real-Time RT-PCR amplicon to genetically type RABV variants. The LN34 assay is used globally as a diagnostic confirmatory test to detect the presence of lyssaviruses, including RABV, in animal and human samples. Sequencing the LN34 amplicon is a practical and cost saving approach; Sanger sequencing of the LN34 amplicon has a cost as low as $3 per sample through sequencing centers or commercial services. As the Nanopore ONT platform has become widely adapted in clinical laboratories, we show that Nanopore sequencing with native barcoding can run up to 96 pooled samples in a single run, costing about $6 per sample currently. Our analyses show that LN34 amplicon sequence provides enough resolution to discern nearly all major genetic clades and most subclades of RABV, which is critical to distinguish rabies virus variants associated with canines in the efforts to eliminate canine-mediated human rabies deaths by 2030.

Key words: Genetic Variant Typing, Real-time RT-PCR, Sequencing, Canine Rabies, Wildlife Rabies

ES4o - The widespread Tadarida brasiliensis population influences the distribution of rabies virus in Chile: preliminary results

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Understanding the spatiotemporal dynamics of host-viral spatial spread is important for rabies prevention and control. In bat rabies, correspondence between bat and virus population genetic structure has been observed for several host-virus pairs, but results differed among species and additional examples are needed to understand context dependencies related to bat ecology. Hypothesizing that bat migration might homogenize viral genetic diversity, the aim of this study is to quantify the extent of the population structure of the widespread insectivorous bat Tadarida brasiliensis in Chile and asses its influence on the phylogeographic structure of the rabies virus associated with this species in South America (TbRV-SA). Bat population genetic structure was analyzed using cytochrome b sequences obtained from oral swabs of T. brasiliensis individuals submitted to the national rabies surveillance program of the National Health Institute (ISP) in Chile. Rabies sequences for bats affected by rabies in Chile were obtained from Genbank and compared with the regional distribution of T. brasiliensis cytochrome-b sequences. Phylogenetic analysis indicated that both T. brasiliensis and rabies sequences were dispersed throughout all Chilean regions without evidence of sub-national clustering. This finding suggests a homogenized population structure of T. brasiliensis across Chile, likely explained by the migratory behavior of this species and the absence of natural barriers within the country. As an incidental finding, several T. brasiliensis rabies sequences in urban areas in central Chile clustered with viruses from other bat species, but no other bat species were infected by TbRV-SA. This putatively asymmetrical cross-species transmission might reflect host behavioral, viral, or ecological barriers to cross-species transmission. Understanding bat dispersion dynamics is crucial for developing future guidelines in rabies surveillance programs.

Key words: Tadarida brasiliensis, Bat population, Urban rabies distribution, Chile, Latin America

ES5o - An integrated spatial epidemiological approach to livestock rabies elimination in Brazil: the co-distribution of equine and bovine rabies in 2010-2019

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Rabies is a disease of significant livestock burden in Brazil due to the risk of transmission from vampire bats (Desmodus rotundus). Cattle account for most of the livestock burden but domesticated species such as horses are also affected in sympatric locations.. To maximise the effectiveness of resources, livestock rabies elimination efforts should be focussed to locations where both equine and bovine risk is highest. The aim of this study was to describe the spatiotemporal distribution, hotspots, and risk factors for equine rabies incidence in the most highly incident states of Brazil and develop a map of bovine and equine rabies co-distribution. From 2010-2019, the 5 most incident states for equine rabies were Mato Grosso (n =62), Paran؛n =63), Minas Gerais (n =147), Espírito Santo (n =78), and São Paulo (n =162). We described the data using choropleth maps and a seasonal decomposition analysis, performed a clustering analysis using both Moran's I and Local Indicators of Spatial Association (LISA) and developed a generalised linear regression model to select predictors for a conditional autoregressive (CAR) model. The maps of equine rabies relative risk were used to develop co-distribution maps for bovine and equine rabies. The results showed no indication of seasonality for equine rabies incidence and only Paran؛nd Espírito Santo showed evidence of spatial clustering. Equine rabies risk was positively associated with the distance to the nearest river in Paran؛nd temperature, closed forest of unknown type and the presence of managed pasture in Espírito Santo. The map of co-distribution showed the Eastern municipalities of Paran؛ad high equine and bovine rabies risk. This study shows that the factors driving equine rabies incidence in Brazil are spatially non-stationary and identifies the regions to target integrated rabies control strategies for the most efficient use of resources.

Key words: Equine rabies, Brazil, Integrated control, Livestock, Surveillance

ES6o - Evolution of cases of aggression by suspicious animals and trend of human rabies in Haiti 2017-2022

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Introduction: Rabies is a neglected disease. Haiti depuis des annes fait face a cette maladie The objective of this study is to describe l'evolution of attacks by animals suspected of rabies et la tendance des cas de rages humaine. Methodology This is a retrospective descriptive cross-sectional study. The study included all patients over the period from 2017 to 2022 who were bitten by an animal suspected of rabies in Haiti and who attended a health institution that is part of the national epidemiological surveillance network. Results The country notified over the period from 2017 to 2021, 22,763 cases of aggression by animals suspected of rabies. The proportion is almost the same for both sexes, ie (50.2%) for men and (0.49%) for women. The most affected age group is the 15–49-year-old female group, i.e. 25% of cases, followed by the 15-49 year old male group with (21.38%). The most affected department during this period is the West department (31.92%) followed by the Center department (16.81%). The most affected municipalities are : Port de Paix (8%), Port au Prince (6.65%), Croix des Bouquets (6.54%) and Les Cayes (4.82%). The institutions having received the greatest number of cases of assault are: Immaculate Conception Hospital in Les Cayes (4.58%), Immacule Conception Hospital in Port de Paix (4.40%), HUEH (4.40%), St Therese of Hinche (4.22%). During this period, 7 cases of human rabies were confirmed, or 3,075 cases per 10,000 inhabitants. The specific mortality rate for human rabies was higher in the year 2021 with a rate of 1%. The western department confirmed the highest number of human rabies cases, 57.14% of cases. The most affected sex is the male sex with 57.1% and the most affected age group is 50 years and over 28.5%. the most affected municipality is Aquin 28.5%. Conclusion It is imperative to strengthen the surveillance of cases of aggression in the country, with an emphasis on the western and central departments with the availability of rabies vaccines in all health institutions.

Key words: Rabies, Exposure, Haiti, Agression, Suspicious

ES7o - Fifty years of the National Rabies Control Program in Brazil under the One Health Perspective

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In 1973, the National Rabies Program was created in Brazil through an agreement between the Ministry of Health and Agriculture and PAHO. Since its beginning, it developed integrated action through access to free post-exposure prophylaxis (PEP) to people at risk, dog vaccination campaigns, joint surveillance system and awareness. This study aims to describe human rabies in Brazil under the One Health perspective in these decades, including achievements in control of dog-mediated cases, and challenges in human cases transmitted by wildlife. This paper also explores possible drivers of human rabies in Northeast Region with half of the cases. The first part of this study was descriptive, presenting data and examples by periods. Statistical analysis was performed in the last period (2010-2022) to explore possible drivers. Dog-mediated human cases decreased from 147 to zero; and dog cases from 4,500 to seven. A major challenge is now human cases transmitted by wildlife (bats, non-human primates, wild canids). Most current human cases occur in municipalities with a Tropical and Subtropical Moist Broadleaf Forest biome and a Gini index higher than 0.5. In the multivariable analysis, an association with temperature (OR =1.739; CI95% = 1.181 – 2.744) and primary healthcare coverage (OR =0.947; CI95% = 0.915 – 0.987) was found. It is possible to significantly reduce the number of dog-mediated human rabies cases through the efforts presented. However, Brazil has wildlife variants of rabies virus circulating. The association of human cases with higher temperatures in the Northeast is a concern with climate change. To reduce human cases transmitted by wildlife, it is important to continue distributing free PEP, especially in remote at-risk areas in the Amazon Region, and to increase awareness.

Key words: rabies, control, epidemiology rabies, surveillance, one health.

ROUND TABLE: ¿WHICH ARE THE REGIONAL CHALLENGES TO ACHIEVE THE CANINE RABIES FREE STATUS?

ES8o - Approach to rabies in Argentina

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The rabies is a fatal zoonotic disease that causes serious public health problems in Argentina. In the northwestern and northeastern regions circulate rabies in dogs (virus variants V1 and V2), in the whole country rabies virus circulates in insectivorous bats (V4, V6, and other variants), and in the northwestern, northeastern, and central regions circulates V3 (rabies in vampire bats). The latest cases of V1 canine rabies occurred in 2018, in the province of Salta, in the north bordering Bolivia. Between 2019 and 2022, 5 cases of canine rabies variant 2 were reported in the province of Formosa. In 2021, a case of human rabies transmitted by a cat (bat variant) occurred in the province of Buenos Aires.

Argentina prepared a National Plan for the prevention and elimination of human rabies 2023-2030, with the aim of eliminating human rabies transmitted by dogs and cats through the strengthening of surveillance, prevention, control and education actions.surveillance, prevention, control and education actions The principal lines of action are: 1) Mass canine and feline vaccination in risk areas 2) Federal registration of canine and feline vaccination 2) Control of the canine and feline population with mass sterilization 3) Postexposure prophylaxis for exposed persons 4) Dissemination of prevention messages to the population.

The main regional challenges to achieving the dog rabies free status would be: a) support the countries currently reporting outbreaks of human and canine rabies b) increase vaccination coverage in dogs in those countries that do

not report cases c) have a regional registry of vaccinated dogs d) strengthen surveillance and reporting e) promote rabies education, prevention and control activities f) long-term plans and programs g) interdisciplinary and intersectoral work, based on the approach of "One Health".

Key words: rabies, challenges, elimination, Argentina, Americas

ES9o - Strategies after the elimination of rabies transmitted by dogs in Mexico

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1 Secretaría de Salud

The National Program for Prevention and Control of Human Rabies in Mexico started in the last century with the Anti-Rabies Campaign (1938-1950) and its regulations; the National Health Plans (1974-1976 and 1977-1983) in an effort to reduce the 1,200 deaths occurred from dog-transmitted rabies, registered from 1970 to 1989; having as main strategy the recommendation of the World Health Organization (WHO) on canine anti-rabies vaccination, together with medical-anti-rabies care, using biologicals in cell culture and those available at that time (from nervous tissue). During the following years in the National Health Programs (1984 to 2000), as well as in the Rabies Action Program (2001-2006) and finally in the Specific Action Programs (2007-2012 and 2013-2018), the strategy continued. This was added to the political decision to eliminate human rabies transmitted by dogs as a public health problem that was part of the continental project promoted by the Pan American Health Organization (PAHO) among the countries of the Region, to achieve the goal by start the 21st century. Therefore, it was necessary to develop adjustments in the anti-rabies vaccination strategy, such as carrying out massive, intense and free vaccination of dogs from the first month of age, revaccinating them at the age of three months and one year; using the biological whose quality had been verified and authorized by the Ministry of Health to be used during the National Weeks. In addition to incorporating human antirabies biologics in cell cultures since 1996, the 14-dose scheme (nervous tissue) was replaced by that of five (Vero Cells and PCEC) and the 4-dose scheme is currently used throughout the Health Sector in Mexico. On the other hand, it was important to implement a weekly system proposed by PAHO on rabies surveillance in dogs as the main reservoir and collaterally in humans, which would allow decision-making by the authorities, which was reflected in two adaptations to National Week. The first was to have a date set in March to reduce the transmission of rabies among dogs that occurred between the months of May and June, according to the record in the surveillance system and the epidemiological investigation of each canine case, which allowed knowing that the majority were unvaccinated puppies, that had not been born when National Week was celebrated. The second adaptation was to increase a week of reinforcement, to accelerate the reduction of registered cases of rabies in dogs, together with the activities to control the rabies focus in the entities where cases persisted, joining the state and municipal authorities in the mobilization of resources. Laboratory surveillance was also a priority, as it supports preventive anti-rabies care for people at risk, which makes it possible to assess the quality of National Vaccination Weeks for dogs and has been enriched by incorporating molecular studies on viruses isolated from people. and animals who dead by rabies.

Key words: Strategies, elimination, rabies, dogs, Mexico

ES26o - Regional challenges to achieving rabies-free status: Brazil

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In Brazil, over the last 50 years, there has been a significant reduction in rabies cases in dogs, due to prevention and control actions, which have resulted in the interruption of the circulation of the AgV1 and AgV2 variants of the rabies virus, considered to have the greatest potential for spreading among dogs in urban areas. Taking into account canine cases of the disease and disease surveillance efforts, Brazil is in the process of seeking validation of the elimination of rabies caused by the canine variant, with no records since 2017, more than 7 years ago. Although the country's territory is continental, the current scenario points to non-hematophagous bats as the main transmitters of rabies in urban areas and, in the Northeast, wild canids. It is also worth highlighting the large outbreaks of the disease caused by the transmission of the virus through the bite of hematophagous bats in the Brazilian Amazon region. We can consider, based on studies by the World Health Organization (WHO), that Brazil has rabies caused by variants 1 and 2 of the virus under control throughout the country. This is all due to the satisfactory vaccination coverage of dogs in massive campaigns over a number of years, as well as contingency strategies in border areas, mainly with Bolivia, and areas of higher risk. Like the southern region of the country, which has not carried out canine vaccination campaigns for more than three decades and has no recorded cases of the canine variant of the virus, Brazil has great potential for validation as a canine rabies-free area in the next three years. The Ministry of Health currently has four main pillars of epidemiological surveillance for the prevention and control of rabies, namely: human anti-rabies prophylaxis (pre-exposure and post-exposure), surveillance of the circulation of the virus in domestic, production and wild animals; anti-rabies vaccination of dogs and cats, and health education actions aimed at the population. The challenges for validating and verifying the elimination of rabies in Brazil are: maintaining contingency plans in higher risk areas and at borders; strengthening and expanding laboratory diagnostic capacity; intensifying ongoing training in human anti-rabies prophylaxis (pre-exposure and post-exposure), expanding surveillance of dog bites, integrating existing integrated information systems and, for the Northeast Region, drawing up and implementing a contingency plan for surveillance and control of rabies in wild canids integrated between the Agriculture, environment and health sectors and, finally, investing more in health education.

VACCINES AND ANTIVIRALS

VA1o - Oral rabies vaccination of dogs – new recommendations for field application and integration into dog rabies control programmes

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Introduction: The great numbers of free-roaming dogs in rabies endemic countries play a key role in disease transmission, making their vaccination crucial if the chain of infection is to be broken. But maintaining herd immunity in these hard-to-reach dogs perhaps is the greatest challenge, especially when using parenteral mass dog vaccination (MDV). Oral rabies vaccination (ORV) using vaccine-loaded baits provides an effective alternative to ensure adequate herd immunity in these subsets of susceptible dogs. Objectives Although the efficacy and superiority of this approach over conventional parenteral MDV campaigns has been demonstrated in field trials, countries called for guidance on how best to use this tool. As the 2007 WHO recommendations for ORV of dogs were outdated they were in need of thorough revision. Materials and methods In response to requests from many countries for guidance, an expert group of the United Against Rabies (UAR) Forum on behalf of the Tripartite set out to develop new recommendations on ORV of dogs to facilitate the transition from what has been purely experimental to future practical application of ORV and its integration into national canine rabies control programs. Results and conclusions The result is a comprehensive document that addresses five major ORV-related topics, including (i) vaccine efficacy and safety requirements, (ii) relevant vaccine bait issues, (iii) regulatory matters, (iv) bait distribution systems, and (v) ORV campaign activities, among others. The document is completed with annexes providing additonal information for possible large-scale application of ORV including FAQs. ORV as a supplementary tool to parenteral MDV campaigns may be a game changer in the fight against dog-mediated rabies and accelerate the process if the Zero by 30 goal is to be achieved.

VA2o - Feasibility of oral rabies vaccination of dogs in Mexico: bait acceptance and immunogenicity studies

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Introduction: Mexico has met the WHO requirements for validation of elimination of dog-mediated human rabies in 2019. The core element leading to this success was the vaccination of millions of pets during the annual Mass Dog Vaccination (MDV) campaigns. Background Maintaining the dog rabies-free status in the future will be challenging as rabies still persists in certain wildlife species and the expected perceived reduced necessity for vaccination by pet owners. One potential complementary tool is Oral Rabies Vaccination (ORV) of dogs in areas with rabies-related high risks of dog – wildlife encounters in areas with a relatively low dog vaccination coverage. In the past, several ORV screening studies have been carried out in Mexico. Recently, more targeted studies on bait acceptance and immunogenicity of a selected candidate vaccine, SPBN GASGAS, have been performed in Queretaro State. Material and Methods Three bait types were tested; egg-flavored, fish-meal and a local-made bait from segments of boiled porcine intestine. All baits contained a sachet filled with a liquid blue-dye solution The staining of the oral cavity (incl. tongue) upon release in the oral cavity was used as an indication for successful vaccination during these bait acceptance studies. During a separate study, dogs were offered an egg-flavored bait containing 3 different doses of SPBN GASGAS. Additionally, several dogs received the highest dosage used also by direct oral instillation and as positive control group, dogs were vaccinated subcutaneously (s.c.) with a commercially available inactivated vaccine. Blood samples were collected pre (n=107) – and approximately 5 weeks post vaccination (n=58) and examined by ELISA for the presence of antibodies against the rabies virus. Results and Conclusions It was shown that the egg-flavored bait was not the most preferred bait (68%) compared to the fish-meal (72%) and intestine bait (71%). However, the 'vaccination rate' including dogs not accepting the bait was the highest for the egg-flavored bait (67%) due to its' high efficiency of vaccine release in the oral cavity compared to the fish-meal (53%) and intestine bait baits (51%). Of the dogs that tested sero-negative pre-vaccination and could be relocated for sampling, the following sero-conversion rates were determined; bait– 86%, direct oral instillation – 93%, and s.c. – 100%. The result of this serology study confirmed the results of the bait acceptance study, whereby also 86% (125/145) of the dogs accepting the egg-flavored bait were considered vaccinated (blue dye staining). The results of this study show that the selected vaccine bait can achieve a high vaccination coverage and thus could be useful complementary tool to vaccinate dogs not readily accessible for parenteral vaccination during MDV campaigns.

Key words: Rabies, vaccination, dogs, bait, immunogenicity

VA3o - Large scale ORV campaigns targeted at free-roaming dogs in Namibia

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Introduction: Oral rabies vaccination (ORV) of dogs is a strategy in the global effort to control and eventually eliminate canine rabies. This method involves the delivery of vaccines through baits specifically designed to be ingested by dogs and targets particularly free-roaming and stray dogs, which are often difficult to capture for injection. Objective While ORV of dogs has been mainly applied during small-scale field trials, experience from large scale implementations are lacking. Therefore, we wanted to assess the in-field practicability, effectiveness and vaccination coverage in the Zambezi region, a remote part in Namibia's Northeast, because distribution and accessibility of vaccines to reach target dog populations can be challenging. **Materials and methods:** We used standardized egg-flavoured baits filled with a third-generation vaccine with the highest safety profile. Veterinary staff of the region was trained (1.5 h) in bait handling, vaccination and data capturing. Baits were then offered by teams to local free-roaming dogs and data on bait acceptance as well as handling was captured using a mobile-phone app (WVS/Mission rabies). **Results and conclusions:** During the campaign in 2022, with four teams and within four working days, 3,097 dogs were offered a bait, of which 88,0 % were considered vaccinated. Teams managed to vaccinate, on average, over 20 dogs/hour, despite using a door-to-door vaccination approach. These favourable results in terms of bait acceptance and vaccination as well as field applicability and effectiveness further support the great potential of ORV in dog rabies control programmes. Also, the ORV-only approach is pushing the boundaries of ORV in the field to further enhance the applicability of the method as one mean to reach the goal of Zero by Twenty.

Key words: oral rabies vaccine, baits, free-roaming dogs, Namibia, acceptance

VA4o - The Pathway to approval of an oral dog vaccine bait

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Recently, WOAH announced that the first oral rabies vaccine for dogs has met all safety and efficacy requirements for such vaccines as specified in the Terrestrial Manual. Oral Rabies Vaccination (ORV) of dogs has been identified as potentially a valuable tool to control and eliminate dog-mediated rabies, especially in countries with a large population of free-roaming dogs inaccessible for parenteral vaccination. Several oral rabies vaccines have been developed and licensed for use in certain wildlife species in Europe and North America, but no such vaccine has yet been approved for dogs by the relevant regulatory authorities; as to be expected considering that no dog-mediated rabies occurs in these countries. Unfortunately, a document (Free Sales Certificate [FSC] or Free Trade Certification) issued by authorities in the country of origin that the product has been approved for the specific purpose (species) by the regulatory authorities is often required by third countries not only for commercial use but also for conducting field studies supporting safety and effectiveness. Also, local product registration can be a pre-requisite for importation. Such a local registration procedure is often accompanied by (repetitive) local testing, including animal studies. In recent years, field studies in different settings have shown the feasibility of ORV of dogs using the highly attenuated and efficacious vaccine strain, SPBN GASGAS. Sadly, without harmonization and/or centralization for endorsement procedure facilitating entry in countries with dog-mediated rabies, its beneficial use for achieving the goal '0 by 30' is severely hindered and delayed. To overcome some of these hurdles, it has been decided to submit an application for Marketing Authorization to the European Medicines Agency (EMA) for SPBN GASGAS with the extended indication of ORV of dogs. Hopefully, compliance with European Union requirements and subsequent EMA-approval will facilitate access to many other countries with dog-mediated rabies.

Key words: Dog, oral vaccination, registration, approval, SPBN GASGAS

VA5o - The interface of arctic foxes and free roaming dogs in northern communities in Alaska and Canada. VA5o

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The far North of Alaska and Canada is characterized by vast landscapes, a harsh climate, and many small remote largely indigenous communities. These communities often face unique socio-economic challenges based in part on forced cultural changes and difficult logistics associated with living in secluded arctic and subarctic environments in Alaska. Rabies surveillance, prevention and control activities targeting domestic dogs and wildlife to protect human and animal health has proven especially difficult leading to concern around issues of health equity, stewardship, veterinary care, sustainability and wildlife conservation and the need for a multisectoral One Health approach in these communities. Veterinary care is often not easily accessible, and this lack of veterinary care including vaccination and spay neuter programs can lead to uncontrolled breeding and local populations of free roaming unvaccinated dogs. In rabies enzootic areas unvaccinated dogs in close proximity to wildlife pose a risk to the human population particularly during winter months when arctic and red foxes move into to local villages to take advantage of anthropogenic food and increase contact rates between dogs and wildlife. Possible solutions include enhanced rabies surveillance including field and laboratory-based diagnostics to better understand rabies ecology in the vast areas of the circumpolar north, improved general veterinary services to increase vaccinations through lay vaccinator programs and reduction of free roaming dog population, as well as novel vaccination strategies such as oral vaccination of foxes and dogs. Enhanced communication between agencies and affected communities is required to further protect human and animal health and to provide a sustainable approach for effective rabies control strategies.

Key words: Arctic, dogs, foxes, vaccination, surveillance

GEORGE BAER AWARD

GBA1o - Pradinho rabies outbreak, Brazil: Response actions and their intervening factors

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Introduction: The bat-mediated rabies outbreak that affected 4 indigenous children from Pradinho, Bertópolis, Brazil was the most complex in recent years throughout Latin America as it involved a native population with socioeconomic vulnerability, linguistic, cultural and geographic barriers. The One Health approach measures undertaken were essential for the surveillance, control and prevention of new cases not only in Pradinho Village, but throughout the Maxakali territory. **Objectives:** The objectives of the work were to list the response measures to the outbreak of human rabies that occurred and relate them to the challenges for their execution. **Experimental design:** Descriptive, documentary, observational and retrospective study of a quantitative nature. **Material and methods:** A Task Force was formed with a multidisciplinary team of civil servants from the federal, state and municipal spheres. The actions were implemented between April 4 and July 7, 2022 throughout the Maxakali territory. Data were extracted from the Technical Reports of the Special Indigenous Health District of Minas Gerais and Espírito Santo (DSEI-MGES), the Agricultural Institute of Minas Gerais (IMA-MG) and the Animal Anti-Rabic Vaccination bulletins. The researcher visited the places where such interventions took place. **Results:** With this outbreak imminent, it was necessary to implement rabies control actions aimed at humans, animals and the environment in the Pradinho territory. Such actions were extended to the villages of Santa Helena de Minas, Ladainha and Teófilo Otoni. The main intervening factors involved that impacted the execution of the Task Force are presented below.

Table 1- Task force production and its intervening factors

Actions carried out	Quantity	Intervening factors
Pre-exposure prophylaxis (day 0)	2495	Resistance to the procedure due to family grief; Absence of the individual at home to undergo the vaccine; Refusal to be transported to the hospital unit for a dose of HRIG.
Pre-exposure prophylaxis (day 7)	2457	
Post-exposure prophylaxis (day 0,3,7)	43	
Post-exposure prophylaxis (day 14)	38	
Anti-rabies immunoglobulin	25	
Anti-rabies vaccine blockade in dogs	427	Collaboration of owners.
Anti-rabies vaccine blockade in cats	126	
Home and farm inspections	100	
Identification of bat shelters	41	Difficult to reach places Commitment of the team involved.
Capture of vampire bats	936	
Treatment of vampire bats	936	
Analysis of bat samples by IFD	5	Commitment of the team involved.
Identification of spoliated cattle	10	
Lectures for indigenous people	7	Language barrier.
Regional radio intervienws	3	Commitment of the team involved.

Source: DSEI-MGES and IMA-MG, 2022

Discussion: Prophylactic human and animal anti-rabies immunization actions and environmental control implemented occurred in a timely manner and were essential for a quick and effective response to the emergency. Despite the interference of the language barrier and the difficult to access places, the actions were not compromised and the health education lectures for indigenous people were central components to avoid new risk exposures to the rabies virus among Maxakali children and the bat. **Conclusion:** The control and prophylactic actions undertaken in response to the aforementioned outbreak were important and constitute a typical model of regional efficiency that can be reproduced in other regions of Brazil and Latin America.

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IVANETE KOTAIT AWARD

Early transcriptional modulation of SLC genes during rabies pathogenesis: possible crosstalk with glutamatergic pathways and neuronal protection in the brain

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Introduction and objectives: The resurgence of rabies in post-pandemic Brazil has highlighted the need for new research on host-virus interactions. While RABV-induced neuroglial dysfunction involves the neuronal transporter's dyshomeostasis, its neurochemical basis remains poorly investigated. The glutamatergic system mainly regulates the Central Nervous System's (CNS) excitability, modulating both neuronal survival and death. However, it is unknown whether RABV infection affects glutamate-related genes in the CNS. Therefore, we characterized the transcriptional modulation of Solute Carriers (SLC) transporters (SLC30A2, SLC20A2, SLC1A3, and SLC1A2) during the early rabies stage. Experimental design: This study integrates transcriptional data for preliminary guidance in validating RABV infection through in vitro assays. **Methods:** We gathered open-access RNA sequencing data from the GEO database, focusing on human data with at least three samples and a wild-type infection. The GSE178583 dataset was used in the RStudio DESEq2 package, specifically the Likelihood Ratio (LRT) method to account for time point effects on gene expression. We stratified differentially expressed genes (DEGs) based on log2 fold-change > 1 (upregulated) or < -1 (downregulated) with an adjusted p-value < 0.05. Additionally, we conducted Gene Ontology (GO) analysis using EnrichR. **Results:** PCA data revealed time-dependent stratification of the genes (Figure 1A-D). GO analysis indicated that transmembrane transpor-

ters are involved in responding to unfolded proteins (Figure 2A-C), with 99 commonalities across different time points (Figure 2D). Notably, SLC30A2 was upregulated, while SLC20A2 was downregulated (Table 1). SLC1A3 and SLC1A2 showed no significant changes during the period. Discussion: The SLC superfamily includes transmembrane protein transporters. SLC30A2 encodes the zinc transporter (ZNT-2), which regulates Zinc (Zn2+) levels. Kainate-evoked Zn2+ efflux negatively regulates calcium signaling, protects neurons from overexcitation and influences glutamate release. The upregulation of SLC30A2 in the early stages of rabies infection may relate to increased Zn2+ levels, addressing our GO analysis. It may potentially protect neurons during this phase, also highlighting its role on synaptic dysfunction on disease onset. SLC20A2 encodes PiT2 protein, one of the main neuroglial inorganic phosphate (Pi) sodium-dependent transporters. PiT2 interplays with vesicular glutamate transporters (VGLUTs) in synaptosomes to maintain Pi levels. Our analysis found that SLC20A2 remained downregulated over time, which could impact phosphate levels in the microenvironment of RABV-infected cells. Although it may have compensatory mechanisms, increased Pi concentrations influences brain calcification and possibly neurite growth, leading to morphological dysfunction. Unlike West Nile virus (WNV) infection, our analysis did not detect significant changes in genes responsible for glutamate uptake, represented by SLC1A3 and SLC1A2. This expression might be due to experimental limitations related to time points, suggesting the need to systematically evaluate the expression of glutamate-regulated genes throughout the disease onset. **Conclusion:** These findings suggest that RABV infection modulates SLC transporters mainly involved in Zn2+ regulated-functions, through glutamate crosstalk, as a possible mechanism for neuronal protection.

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Figures and Table

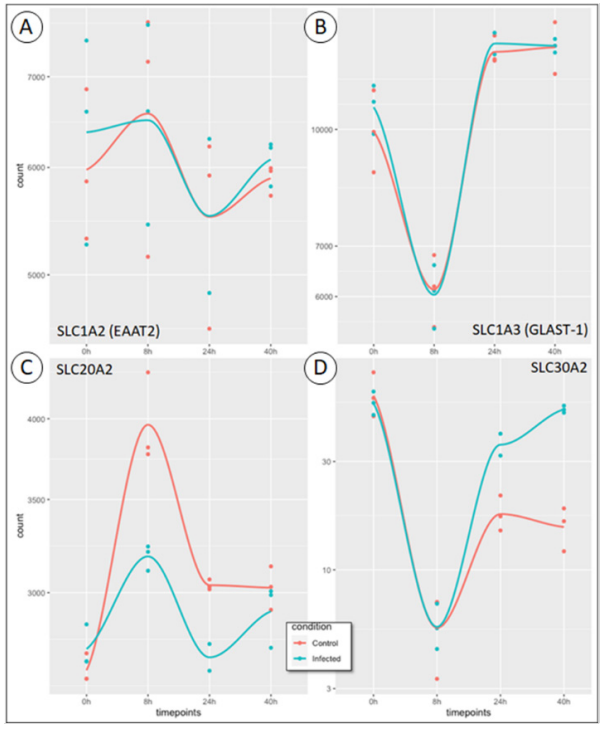

Figure 1. Principal Component Analysis (PCA) of gene expression. This result demonstrates the stratification according to the variance distribution of the genes by time. The red line represents the control group, and the blue line shows infected samples.

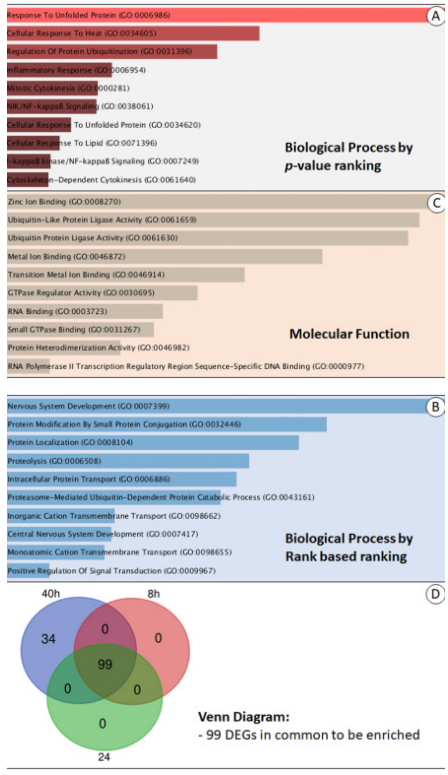

Figure 2. Gene Ontology (GO) analysis of the Differentially Expressed Genes (DEGs) during RABV infection. This figure illustrates the biological process in which the DEGs are directly or indirectly modulating. A) The most prominent and significant biological process modulated by RABV-modulated genes according to the p-value; B) List of biological processes according to rank based test; C) Genes-regulated molecular functions; D) Venn Diagram identification of DEGs commonly expressed between the time points.

Table 1. Data on the expression of SLC30A2, SLC20A2, SLC1A3 and SLC1A2 throughout RABV early kinetics.

Gene name	8HPI		24HPI		40HPI	
	log2foldchange	*padj*	log2foldchange	*padj*	log2foldchange	*padj*
SLC30A2	3.358272752	0.004857	1.85268241	0.004857	1.85268241	0.004857
SLC20A2	-0.537101355	0.000213	-0.146602568	0.048033	-0.146602568	0.048033
SLC1A3	log2foldchange = -0.09 / padj = 0.99					
SLC1A2	log2foldchange = -0.05 / padj = 0.99					

HPI: hours post-infection.
padj: Adjusted p-value.

WILDLIFE RABIES CONTROL

WR1o - What are wildlife and people telling us? Considerations and conundrums in wildlife rabies management

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Most techniques and strategies for management of diseases in wildlife populations remain in the early research, development, and discovery phases. Rabies in wild mesocarnivores is the only zoonotic disease impacting human and animal health that is managed at the source and at a landscape scale in parts of the Americas, Eurasia, and the Middle East. We can now target and successfully vaccinate a diversity of free-ranging mesocarnivores across a wide variety of habitats with oral rabies vaccines distributed by fixed-wing aircraft, helicopters, vehicles, and bait stations. Wildlife rabies management methods are generative in nature and require a detailed understanding of species ecology, habitat use, foraging patterns, population density, as well as biological and social carrying capacities. Willingness to adapt and adopt new technology to refine logistics of oral rabies vaccine distribution as well as novel rabies diagnostic techniques to improve enhanced rabies surveillance and program monitoring is critical to success. A "right now" societal, cultural, and political mindset impacts support for long-term wildlife management objectives that may require decades to accomplish. Conflicting funding priorities and other challenges require new methods of communicating science and evidence-based wildlife rabies information and the development of innovative approaches for marketing and branding programs. One Health collaborations for wildlife rabies research and management demands sustained leadership and ongoing stewardship of multisectoral relationships and the ability to be patient, present and deliberate in approaches to strategic planning and subject matter expert (SME) engagement. The use of structured communication and consensus building techniques involving SME's (including the Delphi method and expert elicitation panels) facilitates forecasting, timely decision making and fresh perspectives on best management practices for wildlife rabies management. Considerations for the elimination of raccoon rabies in the USA by 2063 highlight these issues towards best practices in wildlife health management in the 21st century.

Key words: Wildlife, management, ORV, surveillance, SME, rabies, zoonoses

WR3o - Exploring Rabies Transmission Dynamics at the Urban-Rural Interface: Engaging Student Citizen Scientists through Remote Camera Technology

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Understanding the dynamics of rabies transmission, particularly at the urban-rural interface where humans, dogs (Canis lupus familiaris), cats (Felis silvestris catus), and wildlife interactions are prevalent, is crucial for effective zoonotic disease management and prevention. The Navajo Nation's Dine College implemented a project focused on engaging university students enrolled in Vertebrate Zoology as "citizen scientists". The project provides undergraduate research experience using the investigation of suburban/rural animal activity, anthropogenic food and shelter resources, animal interactions, and monitoring using remote camera technology. The project is in its third year and has deployed remote cameras strategically in student-selected sites along the suburban-rural interface throughout the Navajo Nation, an indigenous reservation located in the Southwestern United States. The most common student-selected sites for observation were locations of indirectly provided anthropogenic food and shelter resources, such as outdoor cat and dog feeding and human refuge storage. The observations centered around the five days on the full and new moons, spanning sunset and sunrise between the months of March and May. Student-placed cameras recorded animal activity including human-adapted wildlife, feral and free-roaming dogs and cats, temperature, lighting, and weather conditions at the time of observation. Students analyzed data acquired from the remote cameras. Students sorted and analyzed their collected images to assess the presence, behavior, and potential interactions of these animals and the current environment. The most relevant project results have been a correlation with the phase of the moon affecting numbers, species, activity observed, and the excited level of engagement of STEM students in doing their first field research. This project shows the value of engaging students in STEM field research and by extension, community "citizen scientists", to benefit Rabies research and improve the data pool for targeted anrabies.

Key words: Transmission dynamics, Anthropogenic urban-rural interface, Citizen scientists, Remote camera technology, ti-rabies vaccine campaigns.

WR4o - Rabies virus serosurvey of the small Indian mongoose (Urva auropunctata) across multiple habitats in Puerto Rico, 2014-2021

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3 USDA APHIS WS National Rabies Management Program

Introduction: The small Indian mongoose (Urva auropuncata) is a rabies reservoir in Puerto Rico and accounts for over 70% of reported animal rabies cases annually. Oral rabies vaccination (ORV) is used to control and eliminate rabies virus in wild carnivore populations at a landscape scale in the United States and has been proposed for mongooses. The presence of rabies virus neutralizing antibodies (RVNA) is often used to measure rabies virus exposure in wildlife populations or measure seroconversion rates following ORV as an index to population immunity. Surveys for RVNA targeting reservoir hosts across habitats can contribute to spatial estimation of rabies infection risk across the host geographic range. **Objectives:** We conducted a sero-survey of mongooses across multiple habitats in Puerto Rico to evaluate natural rabies virus exposure in mongooses and whether seroprevalence varied by habitat type. **Materials and Methods:** We sampled mongooses at 11 sites representing seven habitat types across Puerto Rico: 1) dry grasslands, 2) mangrove forest, 3) rainforest, 4) agriculture, 5) seasonal wetlands, 6) dry limestone shrubland, and 7) moist grasslands. We shipped sera to the Rabies Laboratory at Kansas State University for RVNA analysis using the rapid fluorescent focus inhibition test and considered samples with titers > 0.1 IU/mL as evidence of RVNA. Results and Conclusion We sampled 464 unique mongooses during 2014-2021. Overall, 80/464 (17.0%; 95% CI: 14.1 - 20.9%) of mongooses sampled across all habitats were RVNA positive. Mongoose RVNA seroprevalence was greatest in populations inhabiting moist grasslands and lowest in populations sampled from mangrove forests. Population-level RVNA seroprevalence is dynamic in mongoose populations and seroconversion among re-sampled individuals can reveal evidence of active rabies virus circulation as a complement to case surveillance. Our results may shed light on rabies virus transmission across habitats to help refine rabies management activities for mongooses in Puerto Rico.

Key words: Habitat, Mongoose, Puerto Rico, Rabies, Serology

WR2o - Investigation into arctic fox oral rabies vaccination to reduce the rabies risk in Churchill, Canada

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Introduction: Churchill is a town of significant ecological interest in northern Manitoba, Canada that sits along the western coast of Hudson Bay. In spring of 2022, it had a spike in rabies cases due to the arctic fox variant which resulted in multiple human and domestic animal exposures. The Churchill Rabies Management Working Group met in June of 2022 to evaluate the unique rabies risk in the region. Six key action points were outlined by the Working Group, one of which was to determine the feasibility of wildlife vaccination. **Objectives:** To investigate the efficacy of vaccinating arctic foxes and red foxes to reduce the rabies risk to the Town of Churchill, in northern Manitoba, Canada. Additionally, the project will aim to see if the past rabies outbreaks fit a pattern proportionate to lemming population peaks that occur approximately every 4 years. The project will use the limited passive surveillance data (2001-2022) from the region, and rabies post-exposure prophylaxis data for the same region in the same time period. **Methods:** Manitoba Agriculture partnered with the Churchill Fox Project, run by the University of Manitoba, and the Public Health Agency of Canada (PHAC) to model wildlife rabies for the Churchill region. The fox oral vaccination model began parameterization in June 2023,

and results will be used to inform vaccination strategies, if feasible. The project will engage experts in wildlife oral vaccine administration and the local wild fox population to create a plan that is appropriate for the area. Conclusions: Model parameterization has begun but initial outputs are not expected until early 2024. If fox vaccination is a viable strategy to reduce rabies transmission between the foxes, the next step is to compare vaccination strategies to assess the most financially feasible option.

Key words: arctic fox, rabies, oral vaccination, modelling, Churchill

WR6o - Immunogenicity of recombinant live rabies virus vaccines in raccoons

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Introduction: Rabies is a lethal viral zoonosis that continues to threaten human and animal health globally. In North America, wildlife serve as natural reservoirs of rabies virus (RV) and the raccoon (Procyon lotor) RV variant has been targeted for elimination in the eastern United States. Oral rabies vaccination (ORV) is integral to wildlife rabies control programs. Objectives. We experimentally evaluated the immunogenicity of a recombinant RV (ERAg333) vaccine via direct installation into the oral cavity of raccoons, in a prime-boost exploratory design. **Methods:** Three ERAg333 formulations were administered orally to raccoons, and the post-vaccination (PV) serum antibody response was measured across time points. Serum RV neutralizing antibody (RVNA) was measured by rapid fluorescent focus inhibition test, and RV binding antibody (RVBA) was measured using a commercial blocking enzyme linked immunosorbent assay. One vaccine formulation was modified and then similarly re-tested. Mock vaccinated or unvaccinated raccoons served as controls during each experiment. **Results:** Oral vaccination with ERAg333 induced low RVNA seroconversion in raccoons, ranging from 50% (formulation B) to 0% (formulation C). Booster vaccination increased RVNA seroconversion to 70% with formulation B, yet no seroconversion increase was observed following booster doses with the two other formulations. Raccoon vaccination with a modified formulation B resulted in 40% RVNA seroconversion after the initial dose and 100% seroconversion after the booster dose. No serum RVNA nor RVBA were detected in unvaccinated controls. Serum RVBA results agreed with 87.9% (n=321) of RVNA results; however, the RVBA data suggest a greater fraction (100%) of seropositive raccoons following the primary dose of modified formulation B than observed from the RVNA data. Conclusions. Our study supports the immunogenicity of certain ERAg333 vaccine formulations for raccoons. Refining existing recombinant vaccine platforms and technologies may improve the effectiveness of ORV for raccoon RV control in North America.

Key words: antibody, oral vaccination, raccoon, recombinant rabies virus, vaccine

WR7o - Rabies virus surveillance in wildlife: a pilot of inter-institutional cooperation within the One-Health Framework

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In Colombia, wildlife rabies transmitted by bats and sometimes by domestic intermediate hosts such as cats is a lethal zoonosis that poses an increasing public health problem. The last fatal cases of rabies in humans were the result of accidents involving domestic animals infected with wildlife rabies. In addition, global change drivers cause biodiversity loss and ecosystem degradation, increasing interactions between wildlife, domestic animals, and humans. Therefore, it is necessary to implement surveillance and research systems for rabies virus (RABV) in wildlife, characterizing species with potential as reservoirs. For this purpose, a pilot cooperation project was developed between the National Institute of Health (National Reference Laboratory-Virology) and the National Institute of Biodiversity (Humboldt Institute). To strengthen RABV surveillance in order to generate evidence that will help strengthen the understanding of the dynamics of the virus within the One Health framework. For this purpose, during 2022, brains were collected from specimens of Chiroptera and Carnivora from five departments of Colombia. These specimens were collected as part of biodiversity research conducted by the Humboldt Institute. Samples were processed using rRT-PCR for rabies virus (RABV) In National Reference Laboratory-Virology . A total of 192 chiropteran brains were characterized, and two individuals were positive for lyssaviruses of the genera Glossophaga sp. and Carollia sp. These genera have already been reported as carriers of RABV in the Valle del Cauca. Some species of these genera are common in urbanized areas, which increases the risk of possible transmission to humans. This cooperation aims to provide the robust evidence necessary to contribute to decision-making in public health and environmental matters under the One Health approach for understanding the dynamics of RABV.

Key words: arctic fox, rabies, oral vaccination, modelling, Churchill

DIAGNOSTIC

D1o"Improving wildlife rabies surveillance in Puerto Rico - Advances in Laboratory-Based Surveillance and the Potential Impact of Cryptic Bat Rabies Virus on the Island" Dr. Andrew Beron (CDC, USA)

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Introduction: Puerto Rico (PR) and other Caribbean islands consider themselves free of bat rabies. However, PR has a favorable ecosystem to support bat-maintained rabies. A recent rabies serology study among bats in a PR cave found that 6.5% of sampled bats had antibodies to rabies. Each year on average, the PR Department of Health (PRDOH) tests one bat per year, or 0.05 bats per 100,000 human population – less than the continental United States bat testing rate of 7.62 per 100,000 population. Ongoing rabies virus surveillance in PR bats can help demonstrate the presence or absence of bat-maintained rabies virus variants. The CDC proposed to implement a novel method of rabies wildlife sample collection that utilizes community cooperators likely to encounter found dead or sick-acting bats. Objective PRDOH worked with the CDC to improve PR's wildlife surveillance laboratory testing capacity by increasing the annual sample of bats submitted to PRDOH for rabies testing. Materials and Methods PRDOH and CDC met with individuals and members of organizations (n=15) that represented spelunkers, pest exclusion workers, academic research groups, speleologist society members, and conservation groups to discuss the collection and submission of found dead or sick-acting bats during routine activities as part of passive surveillance. The period of study was from September 2022 to August 2023 and the optimal sample size was calculated at 178 bats. Results During this first phase of passive cooperator-based surveillance, thirteen bats of 4 different species have been submitted to the PRDOH for rabies testing and tested negative. Conclusions The past year of cooperator-based surveillance has shown this proof-of-concept works and that this method of passive surveillance can increase PR's bat testing rate. However, to reach adequate sample size, additional effort and engagement with cooperators is needed. While currently focused on bats, this surveillance strategy could be implemented for other types of wildlife.

Key words: Wildlife, Surveillance, Bats, Caribbean, Diagnostics

D2o - Diagnostic evaluation of the first canine-variant rabies cases in Canada in over 60 years

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Introduction: Dog rabies never became established in Canada despite repeated introductions from the United States and Europe during the late 19th and early 20th centuries. Since 1950, wildlife have been the only rabies reservoirs in Canada, though the species involved vary by region. Variant typing did not become routine until the late 1990s, however, based on epidemiological investigation, it is assumed that Canada has been free of canine variant rabies since the 1960s. During 2021, two dogs were separately imported into Canada

from the Middle East as personal pets, and subsequently developed rabies. **Objective:** To provide an overview of these two cases, with a focus on the contrasting clinical and diagnostic presentations that were observed. Lessons learned, including gaps identified in client-laboratory communication, public and professional education, and regulatory actions, will also be discussed. **Materials and methods:** A variety of diagnostic and characterization methods including direct and indirect fluorescent antibody tests, RT-PCR, sequencing and phylogenetic analyses were used to diagnose these cases and identify where the dogs had been infected. **Results:** One dog developed typical clinical signs of rabies within one week of import and was laboratory-confirmed shortly thereafter. The second dog developed clinical signs over 7 months after import, and had an atypical clinical course and unusual diagnostic test profile. N-gene sequencing and phylogenetic analyses demonstrated that both dogs were infected with viruses known to circulate in the country of origin rather than with wildlife variant viruses indigenous to Canada. Conclusions: These cases represented the first documented detections of canine variant rabies viruses in Canada in over 60 years. With increased globalization, and movement of people and companion animals, importation of eliminated rabies virus variants remains a risk for Canada and other countries. Detection of these cases was one of the drivers for renewed discussion on Canadian import requirements for dogs.

Key words: dog rabies, diagnostic testing, Canada, import, risk

D3o - Direct rapid immunohistochemistry test in rabies virus isolates of domestic canids from the Maranhão and Mato Grosso do Sul states, Brazil

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Considering that laboratory surveillance of rabies is one of the pillars for disease control, the Instituto Pasteur (IP) as National Reference Laboratory and Collaborating Center of PAHO, has been working to implement the direct rapid immunohistochemistry test (dRIT) in some regions of the brazilian territory. In this study, the aim were to apply dRIT in RABV isolates of domestic canids and to compare the results with direct fluorescent antibody test (dFAT). Therefore, isolates of RABV from eight samples of domestic canids from the Maranhão (year 2016) and Mato Grosso do Sul states, Brazil (years 2008, 2012, 2015 and 2016), stored in freezer -80°C, were selected from the archive of the Rabies Diagnostic Section from IP, São Paulo, Brazil. For the execution of dRIT mice brain imprints were performed in glass slides, followed by incubation with the biotinylated polyclonal anti-RNP IgG antibody (IP, São Paulo, Brazil) and streptavidin-peroxidase (Vector Laboratories, CA, USA). The reactions were revealed with the chromogen diaminobenzidine (Dako - Agilent Technologies, CA, USA) and observed under an optical microscope. Inclusions and antigenic material of RABV were detected in 8/8 samples evaluated by dRIT. These findings were consistent with those demonstrated by the dFAT and had previously positive results RT-PCR with genetic sequencing compatible with domestic canids strains in 6/8 samples (variant 1) - Corumbá, Mato Grosso do Sul/Brazil; 2/8 samples (variant 2) - São Luís, Maranhão/Brazil. The results corroborate the previous studies of the our group demonstrating the usefulness of the dRIT for the diagnosis in different animal species, not only related to the genetic viral lineage compatible with Desmodus rotundus, but also the strains of domestic canids. In this way, they reinforce the importance of dRIT as a primary diagnostic technique, which can improve the surveillance and the actions for control this neglected zoonotic disease in Brazil. This study was financed by the National Council for Scientific and Technological Development (CNPq), Brazil – number 420003/2021-5 and Instituto Pasteur, São Paulo, Brazil (IP number 04/2022).

Key words: Diagnosis, Animal rabies, Direct rapid immunohistochemistry test, Polyclonal antibody, Instituto Pasteur

D4o - Automated detection of neutralising antibodies utilising a fluorescent rabies virus

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Introduction: The measurement of neutralising antibodies against Rabies virus (RABV) was simplified by using a recombinant RABV strain expressing mCherry protein (termed mCCCG). The newly developed neutralisation test using mCherry-producing virus (NTmCV), enabling the direct visualisation of infected cells, achieved equivalent results with the Fluorescent Antibody Virus Neutralization (FAVN) assay. **Objective:** To integrate NTmCV into an automated reading process. Materials & Methods: A panel of sera from humans, healthy rabies-vaccinated dogs, cats, and control samples (WOAH & WHO reference sera) were tested using the NTmCV assay. The Cytation 5™ cell imaging multimode reader (Agilent Technologies) was used to read and analyse the panel. Image analysis was conducted in two stages using the Brightfield system to assess the cell monolayer and the Texas Red filter to evaluate the mCCCG infection of the cells. To ensure accurate assessment, each plate included a cell control, which served as a calibration reference for an acceptable cell monolayer and was used to set the threshold criterion. Wells with incomplete cell confluence or any cytotoxic effects were identified and excluded from the evaluation. To detect the mCherry signals, the optimal cut-off point was determined by employing a series of microtiter plates containing infected and noninfected cells. Subsequently, both manual and automated readings of the NTmCV plates were conducted, and a comparative analysis of the results was undertaken. **Results:** The automated reading yielded 100% agreement on the virus titration, negative rabies dog serum, WOAH reference dog serum, WHO reference serum and the test samples. **Conclusion:** The mCherry fluorophore can be efficiently detected using an automated image reader. These results offer the potential to expand the use of mCCCG to automated neutralisation assays, requiring minimal human intervention.

Key words: Rabies, Virus neutralisation, mCherry, NTmCV assay, Automation

D5o - Implementing rabies virus nanopore sequencing in Zambia

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Rabies is a neglected disease which suffers from a lack of resources for adequate surveillance. Rabies is endemic in Zambia, with dog-mediated human rabies cases reported annually. Prior to 2022, rabies diagnostic capacity in Zambia was limited, with the Direct Fluorescent Antibody assay (DFA) as the standard test. Over the last 10 years, a few genetic studies using the partial nucleoprotein (N) gene were conducted by a local university in collaboration with foreign entities, but otherwise rabies virus characterization in Zambia has been limited. With the objective of strengthening laboratory capacity for rabies diagnostics, the US CDC provided in-person training and resources to implement the Pan-Lyssavirus LN34 real-time RT-PCR assay and rabies virus variant sequencing capacity using the Oxford Nanopore MinION at the Central Veterinary Research Institute, while at the same time supporting surveillance infrastructure to increase sample submissions. By using primers that broadly amplify the complete nucleoprotein and glycoprotein genes across diverse rabies virus variants, 53 rabies isolates collected across Zambia during 2022–2023 from dogs, cattle, jackals, and two humans were sequenced. All Zambian rabies strains were part of the cosmopolitan canine rabies lineage and Africa 1b clade. The phylogenetic analysis identified four rabies clusters. The major cluster was established across the central part of the country; the remaining three clades were closely related to rabies previously detected in neighboring countries of the Democratic Republic of the Congo and Tanzania; spillover between wildlife (jackals) and dogs was also observed. Using Flongle flow cells on a portable sequencer is a low-cost approach that can help monitor rabies distribution and variants in reservoir populations, especially in rabies-endemic countries, with limited resources for rapid rabies characterization, or countries targeting canine rabies elimination.

Key words: Canine rabies, Nanopore sequencing, Phylogenetics, Zambia rabies surveillance, LN34 real-time RT-PCR assay

D9o - Implementation of wooden applicators as an alternative in the dissection of the brain for the diagnosis of Rabies virus

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Many of the countries where rabies remains a threat to human and animal health lack access to prophylaxis and efficient laboratory diagnosis. Mainly due to the scarcity or insufficiency of equipment, reagents, and dissection materials. This leads to underreporting of rabies cases in some places. In this study, we propose an economical alternative to dissect the brain without using sharp material or dissection equipment. The objective of this study was to implement the use of wooden applicators in the fluorescent antigen test (FAT). A total of 5225 samples were analyzed from 2016 to 2019 of the species: Canis lupus familiaris (n= 5000), Felis catus (n= 200), insectivorous bats (n=18), and the common vampire bat Desmodus rotundus (n=7). To obtain the brain structures for rabies diagnosis, wooden applicators with a thickness of 2 mm previously sterilized by steam were used. They were manually cut in half leaving a sharp splinter. The thinner end is sharp enough to incise the dorsal surface of each cerebral hemisphere and remove Ammon's horn, medulla, and cerebellum for imprinting. The results obtained demonstrated that the use of wooden applicators in the FAT is easy and effective for the dissection of Ammon's horns, medulla, and cerebellum. The advantages of these wooden applicators were proved: 1. Time is reduced during sample processing since a stop to sterilize previously used dissection equipment is not required; 2. Budget, while a dissection kit costs on average $55 dollars 100 wooden applicators cost $1 dollar; 3. Risk of contamination between samples is minimized during the process of the FAT.

Key words: Wooden applicators in the FAT, Laboratory diagnosis, Dissection, Diagnosis, Rabies viru.

BATS RABIES

BR1o - Control of the transmitter "hematophagous bat" within the framework of the program for the prevention and control of Rabies of Wild Origin in Colombia

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The Colombian Agricultural Institute - ICA as institution encomended of ensuring agricultural health in Colombia, and within the framework of the National Program for the Prevention and Control for Rabies of Wild Origin (ROS) in its chapter 3 - Resolution 2602 of September 17, 2003, establishes the epidemiological surveillance and control of transmitters (blood-sucking bat) of Rabies of Wild Origin - ROS. This activity must be carried out by trained personnel, who will carry out the identification and bat´s classification for its subsequent sacrifice and release or shipping to the National Veterinary Diagnosis Laboratory (LNDV), these actions are aimed at reducing population of blood-sucking bats (Desmodus rotundus) in risk areas; control measures and prevention of attacks on production animals by populations of bats possibly infected by rabies virus. Our aim was to present the control and monitoring activities of the captures of hematophagous bats established within the framework of the National Program for the Prevention and Control of Rabies of Wild Origin (ROS) in risk areas. Based on the analysis of the case, ICA will determine the method required to control the blood-sucking bat, including the use of vampiricidal ointment at the site of the fresh bite and the use of mist nets in corrals, pastures, caves or shelters.

Reducing the risk of attacks on livestock farms and therefore the presentation of possible sources of the disease which is lethal for domestic and wild animals and can affect human health. We conclude that the control of the transmitter is one of the activities that the ICA has established to keep an eye on the dynamics of the viral activity of the hematophagous colonies present and to carry out the control of the population of hematophagous bats in Colombia.

Key words: *Desmodus rotundus*, control, monitoring, captures

BR8o - Situation of livestock rabies and the use of contact network to support hematophagous bat and rabies surveillance

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According to data from the Regional Information System for Rabies Surveillance of the Americas (SIRVERA) during the period of 2017 to 2022 occurred 9,351 outbreaks of rabies in livestock in 21 countries of the Americas, resulting in 12,169 positive cases, from which, 97.4% of the cases occurred in areas where the *Desmodus rotundus* bats is distributed. Based on the self-assessment of the national programs of the Americas, the surveillance is one of the most important gaps in the control of livestock rabies, due to decrease in investment and decrease in human resources to maintain the activities. This work proposes the construction of a methodology based on a transmission model incorporating geographic and behavioral determinants of the vampire bat to direct and optimize the epidemiological surveillance and control of livestock rabies. This model was built using a bimodal network connecting vampire bat roosts among themselves (roost-roost-network) and with farms (roost-farm network) in eastern Sao Paulo State, Brazil. These roosts were grouped in 9 communities, some very interconnected, and some not and the farms were grouped in 14 communities. From 2013 to 2017, 44 livestock rabies outbreaks occurred in the area, circulating among the farm communities during the entire period, with possible introductions from neighboring areas. Based on the network and environment parameters, it was possible to reasonably predict livestock rabies outbreak occurrence. The understanding of the interactions between bats and their feeding sources, influenced by the environment, allows to establish more precise measures and, ultimately, with a lower cost-benefit ratio of these actions, supporting the national programs of the Americas to strength surveillance and control activities.

Keywords: Rabies, Livestock, Vampire bat, Desmodus rotundus, Network, Surveillance

BR2o - Use of anticoagulants to control paralytic rabies and common vampire bat (Desmodus rotundus) populations: Historical analysis and perspectives

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Since 1970, one of the methods used to control paralytic rabies has been the use of vampiricides, anticoagulant products designed to reduce the population of the common vampire bat (Desmodus rotundus). From decade of 70's studies on dosage forms of use and active ingredients have been carried out and continue to be a reference when paralytic rabies represents an emerging problem. The objective of this study was to analyze historically and prospectively the effectiveness of the use of anticoagulants for the control of D.rotundus and paralytic rabies. Reference databases were used by designing a search equation with terms related to the topic. Research articles from all years, countries and languages were included, excluding opinion articles informative articles and articles that mentioned this control method without testing it. Excel was used to filter, analyze and recover variables, and tables and figures were designed in RStudio and BioRender to synthesize the results. For the bibliometric analysis metadata were retrieved from Scopus using a search equation based on reference terms. Literature from all years, countries, types and languages was included and results on other chiroptera were excluded. VOS Viewer, Bibliometrix and the R package Biblioshini were used to visualize them. Eighty percent of the articles found were not retrieved due to the year of

publication before the 2000s which limited access to full text. We analyzed 11 articles, 12 variables and visualized 6 bibliometric indicators from a metabase of 90 documents. The results obtained indicate that warfarin was the active ingredient used in 72% of the studies either directly in areas such as the dorsum of the bat or indirectly in bovine wounds. The doses vary from 2-20 mg for its application and the expected effects are observed in an average of 15 days. It was found that it does generate the reduction of colonies and attacks to cattle, but they do not indicate if it is effective for rabies control. There are no studies that evaluate the effectiveness of this method of control of paralytic rabies, it is necessary to generate new studies that update these references and demonstrate its effectiveness.

Key words: vampiricide, culling, blood bat, anticoagulant ointment, public health

BR3o - Molecular epidemiology and phylogeography of hematophagous bat Variant associated with human risk in Colombia

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Rabies virus (RABV) is a public health concern in Colombia. Three genetic variants have been documented in the country: the cosmopolitan (dog variant), hematophagous bat variant, and non-hematophagous bat variant. Monthly reports of suspected human and animal rabies cases are consistently high, despite domestic animal vaccination programs. Recent cases of fatal human rabies have primarily been caused by the hematophagous bat variant, which is mediated by domestic cats. In the case of RABV transmitted by other canid mammals, cases have been identified on time as a potential risk of RABV infection in humans. To understand the genetic, evolutionary, and transmission characteristics of the hematophagous bat genetic variant in Colombia and its relationship with other countries in the American region. Forty-five Colombian sequences of the nucleoprotein gene (1,284nt) collected between 1993 and 2021 were analyzed. These sequences were obtained from routine surveillance conducted by the virology laboratory of the National Institute of Health-Colombia and from sequences from other countries in the American region available in GenBank. Phylogenetic relationships were inferred using the maximum likelihood (ML) method and Bayesian phylogenetic models. Phylogenetic analysis using the ML algorithm revealed that two major monophyletic groups could be determined throughout the Americas region: Clade-A, which includes sequences from Colombia, Mexico, and Peru, and Clade-B, which includes sequences from Argentina, Costa Rica, Peru, French Guiana, and Brazil. Recent Colombian sequences, including the two most recent human cases, were found in Clade-A. Phylogeographic analysis suggests the historical presence of multiple epidemiological corridors throughout the country with different temporal-geographic origins. Evidence suggests that the Magdalena River Valley is currently a possible corridor for the RABV. Maintenance of the number of human rabies cases caused by the hematophagous bat variant necessitates the development of strategies to understand the eco-epidemiology of the rabies virus and its hosts.

Key words: Bat Variant, Colombia, Corridor epidemiologic, Phylogeographic, Surveillance

BR4o - Epidemiological profile of the rabies virus transmitted by bats in the city of Fortaleza, Ceará

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Introduction: Rabies is an acute viral disease that affects mammals, including humans. It is caused by a virus of the Rhabdoviridae family, genus Lyssavirus. Transmission occurs mainly through bites or scratches from infected animals such as dogs, cats, bats and other mammals. Rabies can spread to the central nervous system, resulting in progressive encephalitis that can lead to death. **Objective:** The objective of this study was to investigate the prevalence of rabies in non-hematophagous bats in the city of Fortaleza, Ceará, Brazil, from 2013 to 2022. **Methods:** Data were collected at the Unidade de Vigilancia de Zoonoses in Fortaleza and analyzed by the Laboratorio Central de Saúde Publica. The prevalence of rabies virus in bats was calculated based on the results of Direct Immunofluorescence Assay (DFA) tests conducted on the captured bats. Descriptive statistical analyzes and spatial analyzes were performed to identify geographic distribution patterns of the virus. **Results:** A total of 139 bats were tested in Fortaleza, of which 20 bats tested positive for the rabies virus, resulting in a prevalence of 14%, showing variations over the years. There was a significant increase in 2020 and 2022, reaching 27%. Compared to other regions of Brazil, Fortaleza had a higher prevalence of the virus. The regions with the highest prevalence were close to forested areas in urban regions. The number of bats which were positive for rabies also varied over the years, showing an increase in 2022. **Conclusion:** This study revealed a high prevalence of rabies in non-hematophagous bats in Fortaleza, Ceará. The results highlight the importance of epidemiological studies to understand the prevalence and geographic distribution of the rabies virus in different bat populations. Knowledge of these aspects is essential to develop effective disease control and prevention strategies.

Key words: rabies virus, transmission, epidemiology, bats, Northeastern Brazil

BR5o - Bats Status in Coahuila, Mexico

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Introduction: The state of Coahuila is characterized by having diversity in its wildlife. In scrubland we can find wild cat, desert fox, prairie dog among others; in grassland area: bighorn sheep and puma. Both areas of great interest for livestock because they are an important part of the economy . On the other hand, the forest inhabits black bear, skunk and bat. Aim Monitor the species of bats that are kept in the state of Coahuila. **Material and methods:** For taxonomic identification, there is a series of morphological references according to the family to which it belongs, this together gives us unique characteristics in each species, in addition to bibliographic support for a more precise identification. Four families inhabit the state, 18 genera and 30 species. The species of bats registered in the laboratory are insectivorous, they have generally been found inside caves or in human constructions, such as bridges and houses, the latter have generated several reports of aggression against humans, since when trying to get them out they feel attacked and attack, for all this surveillance through monitoring is important. **Results:** The LESP Coahuila rabies laboratory undertook the task of creating a sample bank with the bats that arrive for rabies diagnosis, either by aggression or monitoring. Its taxonomic identification is carried out, it is labeled and a file is kept with its identification and report as a species that circulates in the state. **Conclusions:** Currently there is a bank of 58 specimens distributed in 3 of the 4 known families and where Tadarida brasiliensis occupies 67% of all bats received for diagnosis. This report presents the diagnostic results of rabies in the available samples.

Key words: Chiroptera, Epidemiology, surveillance, diagnosis, identification.

BR6o - Model for Surveillance, Prevention and Control of Bat-Transmitted Rabies in Urban Areas of Valle Del Cauca, Colombia

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The Rabies virus transmitted by bats in urban areas is gradually replacing rabies in canines, which has been controlled and almost eradicated in some regions of the world. This is becoming a significant public health concern. The Department of Valle del Cauca, Colombia was the first at national level to develop a model for surveillance, prevention, and control of bat-transmitted rabies in urban areas. A descriptive retrospective study was conducted to collect and analyze relevant information, serving as the foundation for proposing this surveillance and control bat-transmitted rabies model in urban areas. This study took in consideration appropriate legal and technical aspects. Of 1321 bats analyzed, 4 had rabies virus with V3 D.rotundus (vampire) and V4 T.brasiliensis (insectivore). The most abundant species were insectivorous M.molossus/buildings and fruit-eating/garden A.lituratus. Risk areas for bat-transmitted rabies in urban areas were classified. Parameters were established for conducting both passive and active surveillance, through main sentinel posts as well as satellite. Changes were proposed in the regulatory framework to implement an epidemiological surveillance system for rabies transmitted by bats, which will be applicable in urban areas, detailing functions and assigning responsibilities at various levels,

with an emphasis on the necessity of integrate actions across environmental, health and agriculture sectors. This surveillance, prevention, and control system for bat-transmitted rabies in urban areas of the Valley allows to be integrated into the national urban rabies surveillance program in canines/humans, as well as the surveillance and control program for bovine paralytic rabies. The model was presented to the Ministry of Health and Environment to study the possibility of integrating it into the national program for surveillance, prevention and control of rabies transmitted by bats in urban areas of Colombia.

Keywords: rabies surveillance, hematophagous bats, non-hematophagous bats, sentinel posts, Colombia

DOGS RABIES

DR2o - Advances to achieve Zero in 2030 in the Americas

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Rabies, a neglected disease, disproportionately impacts communities with limited access to healthcare services, particularly in regions where vulnerable populations reside and work under adverse conditions. These areas frequently witness high rates of unvaccinated dogs and limited availability of preventive measures and post-exposure prophylaxis for humans.

Despite the absence of a curative treatment for rabies infections, timely vaccination remains an effective means of prevention. Coordinated initiatives aimed at eradicating human rabies transmitted by dogs in the Americas were initiated in 1983, with the technical collaboration of the Pan American Health Organization (PAHO). PAHO played a pivotal role in regional coordination for rabies elimination and the operation of a comprehensive regional epidemiological surveillance system for rabies. The enduring solidarity among countries underscores the collective commitment to eliminate human rabies transmitted by dogs. In light of evolving epidemiological trends in the Americas, where human rabies transmitted by dogs is now confined to specific regions within certain countries, while human rabies linked to variants from wildlife is pervasive across the continent, an imperative for an updated Action Plan for the Elimination of Human and Canine Rabies has emerged. The last revision of this plan took place at REDIPRA 16 in Lima, Peru, in 2013. During the REDIPRA 17, in Bogota, Colombia in 2023, was approved an updated Action Plan to reach Zero by 30 in Americas by fostering the complete elimination of canine rabies, subsequently eliminating human rabies transmitted by dogs within the region's countries. This approach recognizes the unique epidemiological contexts and capacities of individual countries, offering a structured path to guide public health management. The specific objectives encompass the delineation of goals, activities, and indicators for this Action Plan tailored to countries experiencing human rabies transmitted by dogs, countries rassling with endemic canine rabies despite the absence of human cases, and countries free from canine rabies altogether. Additionally, the plan prescribes requirements for validation and verification across varying rabies classifications, strengthening surveillance, diagnosis, control, and timely intervention to prevent human and animal rabies, with a focus on reducing endemicity and averting disease resurgence. The plan also prioritizes capacity-building founded on principles of equity and solidarity, with a particular emphasis on safeguarding vulnerable populations. Finally, it underscores the imperative of managing political commitments and resource allocation to fulfill the goal of eliminating human rabies transmitted by dogs.

Key words: Human rabies, control, surveillance, The Americas, challenges

DR1o - Why rabies perpetuates: modelling predictors and barriers to dog vaccination decisions among dog owners in Nigeria

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Mass dog vaccination remains crucial for preventing dog-mediated human rabies deaths. Despite ongoing initiatives to control rabies in Nigeria, evidence from different states indicates suboptimal vaccination rates. We conducted a cross-sectional study between June and December 2022 to enhance campaign planning and increase current vaccination rates. We then built a joint probabilistic model to focus on variations in understanding rabies among Nigerian dog owners. We made two primary contributions to barriers that prevent canine rabies vaccination and factors associated with dog vaccination. First, we model understanding as a latent variable indirectly measured with several targeted survey questions. This method allows a respondent's unobserved understanding of rabies to be estimated using their responses to a collection of survey questions that target different aspects of rabies epidemiology and take various possible response distributions. Second, we model factors influencing pet owners' decisions to vaccinate their dogs against rabies. This analysis allows us to target our primary estimand: How does the latent understanding of rabies influence a dog owner's decision to vaccinate against rabies? as well as to make inferences about the types of barriers that dog owners see as influencing their decisions to vaccinate. Our results indicated that dog owners who indicated a veterinary establishment in their location were more likely to select cost as the primary barrier. Latent understanding was a predictor of dog vaccination. Civil servants were more likely to vaccinate their dogs against rabies than privately employed individuals. Our findings provide valuable insights to improve rabies control efforts.

Key words: Epidemiology, Modelling, Nigeria, Rabies, Vaccination

DR3o - Alert level before rabies and population status of dogs and cats in the state of Puebla

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Introduction: The state of Puebla-Mexico, between the 80s and 90s, faced rabies as a social and public health problem. It came to present up to 15 deaths and 400 cases in dogs in one year. In 2000 it reported the last death from rabies and in 2010 the last case in dogs. More than 15 years ago, it set its goal of vaccinating dogs and cats against rabies at 1.5 million. It was calculated at a ratio of 1:4 (dog: person). Aim: Identify the alert level for exposure to the rabies virus and recalculate the number of dogs and cats to maintain control of rabies among dogs Material and methods Taking into account the report of aggressions per dog, under compliance with vaccination goals and/or the observation of an overpopulation of dogs, medical units were selected, so that between 10 and 20% of their blocks were randomly selected, to apply the instrument known as "ID: POPULATION STATUS OF DOGS AND CATS, ANTI-RABIES VACCINATION COVERAGE AND COMMUNITY ALERT LEVEL BEFORE RABIES **Results:** Of the total number of people interviewed, 67% have not received talks about anger, 42% do not know what to do in case of aggression and 35% have already been attacked and of these, 79% have received medical attention. 739 houses were visited, finding 2.24 dogs per house and 1 dog for every 1.8 people. Conclusions: Social sensitivity is decreasing, and there is a greater number of dogs, so the program requires operational reengineering and risk communication, which guarantees protection coverage for dogs and cats, avoiding the reemergence of rabies.

Key words: Alert, vaccination, assaulted, Dogs, Attention

DR4o - The potential of unmanned aerial vehicles ("drones") for dog-mediated disease surveillance

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Introduction: Effective disease control and elimination programs require robust disease surveillance systems. However, diseases like dog rabies face logistical constraints that hinder surveillance activities. Specifically, in Arequipa, Peru, dog rabies cases have been linked to dry water channels. Also, feral dogs have been reported living in caves around the city. Conducting surveillance within these channels or in the city periphery is extremely challenging. Unmanned aerial systems ("drones") are increasingly employed for surveillance in diverse

sectors, but limited research exists on their use for epidemiological surveillance. **Objective:** To outline the prospects and challenges associated with employing drones for conducting urban rabies surveillance in hard-to-reach areas. **Materials & Methods:** For the water channels, we used two types of drones, Parrot Anafi thermal and Phantom 4. For the cave dogs, we used only the Parrot Anafi thermal. The Parrot drones were equipped with thermal cameras and the Phantom drone with RGB cameras (full color). We flew drones over four water channels to search for dead or erratic dogs and over four peripheral areas to observe the nocturnal activity of cave dogs. **Results:** Overflights covered partially both study areas; airport regulations prevented us from covering 25% of our study area. Drones with RGB cameras over water channels allowed us to detect dead dogs and identify areas where free-roaming dogs congregate. Thermal cameras and RGB cameras identified dogs in periurban areas at night, but it was not possible to differentiate between cave dogs and owned free-roaming dogs. **Conclusion:** Drones have the potential to improve dog-mediated disease surveillance by providing a faster, safer, and more comprehensive way of monitoring animal populations. However, their effectiveness will depend on factors such as the quality of the drone technology, the expertise of the operators, the capacity for data storage and analysis, and the specific objective of the surveillance system.

Key words: Dogs, Drones, Urban rabies, Surveillance, Zoonosis

DR5o - Building local excellence to create sustainable and scalable rabies elimination programs

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Intersectoral collaboration within a One Health framework are crucial to the achieve the ambitious goal of eliminating dog bite transmitted human rabies deaths by 2030. A public-private-partnership consisting of Mission Rabies, US Centers for Disease Control and Prevention and MSD Animal Health, the International Rabies Taskforce (IRT) was formed to provide targeted advice to advance rabies elimination around the world. It offers strategic work packages to support rabies program rollout, largely through investment in digital tools. The IRT has developed 3 key digital tools, available in in multiple languages, to support rabies programs through guiding mass vaccination efforts, structured post-vaccination surveys, as well as rabies surveillance. The dog vaccination App has been used in over 15 countries to document the vaccination of >2m dogs. In the Americas, Haiti used this App to guide a strategic vaccination program that reached >300,000 dogs. The information collected by the App was critical to understanding dog populations and is now the basis for current dog vaccination efforts. Lack of surveillance not only hampers investment into dog vaccination programs, but is also a gap when countries attempt to apply for rabies freedom designations. The Integrated Bite Case Management App developed by IRT has been implemented in over 12 countries, including several in the Western Hemisphere. To-date, over 70,000 suspected rabid dogs have been evaluated and results have improved in-country control programs and influenced global guidance recommendations. Recently, through close collaboration with IRT experts, rabies surveillance could also be expanded to 9 new districts in Zambia under the leadership of the Department of Veterinary Services, demonstrating the scalability of the App and its field implementation. Looking to the future, IRT is interested in supporting Western Hemisphere countries that wish to transition to evidence-based methods of rabies control through the adoption of electronic data systems.

Key words: mHealth, international collaboration, public private partnership, rabies surveillance, mass dog vaccination

HP14p - Community Participation in the Promotion and Prevention of Rabies in Peri-urban Areas of the Municipality of Ibagué

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1 Universidad Cooperativa de Colombia
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Introduction: Intersectoral cooperation and community inclusion are crucial tools in the global fight against preventable diseases such as rabies and their consequences. **Objective:** To foster intersectoral alliances and promote active participation of residents in peri-urban areas of Ibagué in the promotion and prevention of rabies. **Materials and Methods:** A descriptive research was conducted in the Tutelar hills of Ibagué in collaboration with health and education institutions, divided into four phases, implementing rabies prevention programs and responsible pet ownership. **Results:** 71 families from Pan de Azúcar (28.2%), La Martinica (26.8%), Cerro Gordo (23.9%), and Noroccidentales (21.1%) participated in the study. During "Time 0," dogs and cats were successfully vaccinated. In "Time 1," adults were surveyed, and children were encouraged to join preventive measures. "Time 2" focused on children, distributing T-shirts with the slogan "Among friends, there is no rabies, vaccinate me every year," which increased awareness and participation in annual vaccination. In "Time 3," family inclusion and appreciation gifts strengthened community commitment. An educational booklet and school activities disseminated information about rabies prevention. The project was shared with the Tolima Departmental Zoonosis Council, highlighting achievements and experiences in intersectoral collaboration and community participation in the fight against rabies in peri-urban areas of Ibagué. Conclusions: Active community participation in rabies prevention is fundamental, and intersectoral collaboration allowed for the effective implementation of prevention strategies. This experience underscores the relevance of tailoring science to local needs and promoting public health sustainably through community participation.

Key words: Rabies, Community Participation, Promotion and prevention, Community Participation, Public Health Surveillance

DR8o - Development of a Province-Wide Lay Vaccinator Program: Rabies Risk Management in Manitoba, Canada

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1 Manitoba Agriculture

Introduction: Dogs play an important role in rabies transmission between wildlife, other domestic animals, and people. Many Indigenous and remote northern communities in Manitoba have an abundance of dogs and potentially rabid wildlife, yet don't have regular access to veterinary care. Barriers such as geography, transportation, and socio-economic position limits accessing veterinary services. Unfortunately, unvaccinated dogs are sometimes euthanized after biting instead of being quarantined. By vaccinating dogs in these at-risk communities through a lay vaccinator, fewer people will need to undergo Rabies PEP after a dog bite, fewer dogs will be euthanized for rabies testing, and the human-animal bond can be improved. Objectives: To create a province-wide lay vaccinator program that pairs private veterinarians with interested lay people from remote and Indigenous communities. Together, they will create the terms of their working relationship, including cost sharing, vaccine storage, and record keeping. Through respectful and mutually beneficial relationships, Manitoba's program provides a framework for providing much-needed veterinary preventative care in remote and Indigenous communities. Methods: A working group was created with members from the Manitoba Agriculture, Manitoba Veterinary Medical Association, and the Winnipeg Humane Society. A program proposal was created that outlined the roles and responsibilities of the key program partners, and the expectations for community support, designated vaccinator training, and records keeping and reporting. **Results:** The "Limited Access Vaccinator Program" was developed by the working group and is currently undergoing consultation with veterinary and public health stakeholders, and engagement with Indigenous rights holders. The program aims to: promote animal health and welfare; vaccinate dogs against rabies and distemper; strengthen the community's ability to self-govern and increase community self-determination; enable knowledge sharing on zoonotic disease, Indigenous culture, and the human-animal bond; and promote veterinary medicine. If the program passes the consultation and engagement process, implementation will begin in spring 2024.

Key words: rabies, dog vaccination, lay vaccinator, One Health, remote community

DR9o - Rabies virus exposure in dogs from brazilian indigenous communities by serological analysis

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The high rabies seropositivity in Brazil in bats and wild animals indicates the continuous circulation of the virus and the persistence of rabies virus (RV) in interconnected cycles in nature. Bats carrying RV in areas represent a significant public health risk, endangering pets and humans as sources of infection. Serological tests allow tracking of rabies viral circulation, revealing contact in unvaccinated populations. In addition to ecology and synanthropic contact with animals, indigenous communities have variables that affect virus transmission, such as their cultural habits, genetics, and lack of interaction with other populations. Rabies control, especially in indigenous communities, is essential. The study aimed to analyze antibodies in canine samples from indigenous communities in São Paulo. We analyzed a total of 168 samples of nonvaccinated dogs belonging to the Kopenoty, Nimuendaju, Ekeruá, and Tereguá indigenous communities using the Fluorescent Antibody Virus Neutralization test (FAVN). Antirabies titers higher than 0.5 IU/mL were detected in 6 dogs (3,57%), and 16 (9.52%) showed titers ranging from 0.2-0.5 IU/mL. Seropositivity in indigenous people was also previously detected. All the villages studied have close localities, and indigenous people and their pets have contact with each other. In addition, guardians or other members of these indigenous communities claim to have witnessed dogs hunting and playing with bats. The results imply the circulation of the rabies virus, requiring protection for pets and others in the exact location. Notably, antirabies vaccination has proceeded in all dogs of the villages after the study. The study implies rabies virus circulation in indigenous communities, emphasizing the public health risk and underscoring the need for continued studies to monitor and control rabies risks in these populations.

Key words: dog rabies, serology, one health, vulnerable populations, indigenous communities.

DR10o - The dynamic impacts of mass dog vaccination on rabies incidence

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Introduction: Dog vaccination campaigns have been undertaken regularly in Serengeti District, Tanzania for over 20 years, alongside contact tracing to track rabies transmission. Rabies remained endemic with recurrent outbreaks until 2018 when a period of prolonged low incidence ensued (<0.4 cases per 1,000 dogs annually). **Objective:** To quantify the impact of vaccination on rabies incidence in Serengeti District and identify drivers of continued transmission despite two decades of control effort. **Materials and methods:** We estimated monthly dog vaccination coverage at the village level from numbers of dogs vaccinated and dog demographic rates. Using a generalised linear mixed model, we quantified the impact of prior vaccination coverage and rabies incidence on current incidence. We inferred transmission chains to distinguish local transmission from likely introductions. **Results:** We found that district-wide vaccination coverage fluctuated from 13%-45%, while local (village-level) coverage was more varied, from 0-100%. Outbreaks typically occurred following or during years when large contiguous parts of the district were not vaccinated. Rabies incidence within a village decreases with mean vaccination coverage both in that village and averaged over the district in the prior two months. Numbers of estimated introduced cases remained relatively constant (fluctuating from 1-10 per year) but increased as a percentage of all cases from 2.5% pre-2018 to 25% post-2018 as consistency of vaccination coverage increased. Conclusions: The impact of dog vaccination was initially limited due to inconsistent local coverage, but efforts to increase completeness of vaccination campaigns largely interrupted local transmission. Continued introductions, likely from neighbouring unvaccinated districts, present an ongoing risk, emphasising the importance of scaling up vaccination campaigns to achieve elimination.

Key words: mass dog vaccination, contact tracing, incursions, vaccination coverage, GLMM

DR11o - Case-report for rabies control and novel strategies for rabies prevention in a rural community in the state of Sonora, Mexico

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1 Secretaría de Salud

Rabies is recognized as a public health problem and all canine rabies control and prevention activities are strictly coordinated and funded by the Ministries of health in Mexico. The Sonoran Desert possesses a rich biodiversity of mammals capable of transmitting the virus to humans, previous records show the presence of rabies virus in bats and cats, but none for an infected canine. The present work shows the activities done by the Zoonosis Program of the Sonoran Ministry Public Health in Bahia de Kino, Mexico after being notified of the aggression of a domestic dog who presented clinical signs of rabies. The goal was to evaluate the success of the actions taken around a probable case of rabies by the Zoonosis Program of the Ministry of Health as well the impact that it had on the population. Once the Sonoran State Public Health Laboratory confirmed the presence of rabies virus in the collected sample, a focus area was determined, following the protocols, the brigade members were trained, and a house-to-house vaccination strategy was established to prevent further diffusion of the virus. As a result of the intervention all the alleged humans exposed to the canine received treatment against the rabies virus, a total of 2,833 domestic animals were vaccinated in the community representing 100% of the focal area and 80% of the visited houses. The amount of rabies vaccines applied to canines and felines during the first trimester tripled compared to the previous year in the state of Sonora. Given the relevance of this disease in public health, a salutogenic strategy combining creating awareness in the population against the rabies virus with control and prevention through massive domestic animal vaccination has shown to be of high impact.

Key words: rabies, canine rabies, control, prevention, health promotion

PATHOLOGY AND INMUNOLOGY

PI1o - Experimental pathology in rabies: neurosciences approach

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Neuropathologists who are experts in rabies highlight the paradox of infection: the brain tissue affected by rabies virus undergoes only subtle changes, in no way proportional to the severity of disease. This is especially true when histopathological study is carried out using conventional diagnostic techniques. On the other hand, Kristensson et al (Neuropathol Applied Neurobiol. 1996; 22:179-87), stated that lack of knowledge about the interaction between neurons and rabies virus is mainly 'due to rabies is not a public health problem in the Western world and the lack of interaction between virologists and neuroscientists.

With this background in mind, we began a line of research 20 years ago using mice as animal model. Mouse has been the specie most used for experimental rabies research. Aliquots (0.03 ml) of a CVS rabies virus solution are injected into the hamstring muscles of 28-day-old female ICR mice. Six days later the animals develop advanced signs of the disease. Under deep anesthesia, they are perfused with paraformaldehyde and/or glutaraldehyde intracardially. The brains and spinal cord are removed, and 50 to 100 µm slices are obtained on a vibratome. Alternatively, the animals can be perfused with saline solution or simply extracted fresh and frozen brains. For all experiments, control animals processed under the same conditions are used. In some cases, we have carried out studies comparing the effect of fixed CVS virus with that of wild virus obtained from dog brains. Likewise, we have compared the results obtained by inoculating the virus intramuscularly or intracerebrally.

With this material we have carried out studies of dendritic pathology using Golgi techniques, neuronal and astroglial cytoarchitecture using immunohistochemistry with neuronal or glial markers, electron microscopy, and the evaluation of the expression of different proteins, as well as the effect of infection on the synthesis of neurotransmitters. All these studies have been carried out in different areas of the mouse nervous system: cerebral cortex, subcortical areas, olfactory bulb, cerebellum, and spinal cord. We have also studied the transport of rabies virus from its entry through the peripheral nerves to its dissemination

throughout the central nervous system. We have also carried out a study to evaluate the postmortem preservation time of antigens and viral particles. And to carry out the immunodetection of rabies virus for our work, we have developed an antibody from the inoculation of rabbits with attenuated CVS virus.

Key words: golgi techniques, electron microscopy, immunohistochemistry, preservation time, inmunodetection

PI2o - The Milwaukee protocol for treatment of rabies

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Rabies survival by humans or in animal models is regular. There are 41 laboratory-confirmed human survivors, predominantly in India, Peru, Brazil, and USA. The Milwaukee Protocol (MP) consists of intensive care and is in its 6th version. Rabies is poorly cytopathic and acts as an acquired metabolic disorder. The clinical syndrome varies by phylogeny (dog, insectivorous bat, vampire bat) with insect bat having the worst outcomes. Survival and complications are determined by the host immune response, including receipt of vaccine or immunoglobulin. Vaccination improves survival and worsens functional outcome. Rabies remains the world's second vaccine preventable disease after 138 years; human vaccines still derive from the 19th Century and lag animal rabies vaccines. Challenges to improving survival include neglect, false dogma, rapid progression and high mortality, logistics, and drug and research regulations. Sources of optimism include human resourcefulness, the internet, point of care tests (RAPINA, ultrasound), multiomics (future), gene therapy (AAV), and novel vaccine strategies (mRNA, BCG). Decentralization may be the key to progress.

Key words: therapy, survival, phylogeny, immunology, [brain diseases, metabolic]

PI3o - Immune response against different variants of the rabies virus directs the course and clinical manifestations of the disease

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The immune response is crucial to the survival of the host against the rabies virus infection, not only the humoral response, but also the cellular response contributes to the production of specific antibodies. However, different viral variants could influence the immune response profile and clinical manifestations. So, the aim of this work was to perform a comparative study in samples of paraffin CNS by immunohistochemistry for evaluated of cells expressing cytokines of the Th1/ Th2/Th3/Th17 profiles in human rabies cases transmitted by dog (variant 2, epidemiological/clinical information) and Desmodus rotundus (variant 3). The casuistic consisted of ten cases by variant 2 and eight cases by variant 3. All immunostained cells expressing the cytokines (TNF-alpha, IFN-gamma; TGF-beta, IL-1 beta, IL-2, IL-4, IL-6, IL-10, IL-12, IL-17, IL-23), as well as cells immunolabelled with viral antigen were quantified using a grid-scale in an area of 0.0625 mm2, considering 40 fields of the CNS. Results were expressed in number of cells per mm2. Statistical analysis was carried out using non-parametric test of Mann-Whitney with significance level of $p \leq 0.05$. In relation to the viral antigen was observed an increase significant in human rabies by variant 2 ($p < 0.0001$). Regarding the expression of cytokines, we did not observe statistical difference to TNF-alpha, IFN-gamma, IL-1 beta and IL-4 between groups. Statistically significant differences were verified regarding the cytokines TGF-beta, IL-2, IL-6, IL-10, IL-12, IL-17 and IL-23 ($p \leq 0.05$). Except for IL-10, the expression of these cytokines was higher in rabies cases by variant 2. The immune response against rabies virus infection by variant 3 seems to be driven by a Th2/Th3 profile, with a longer survival of these patients (average 12 days) and a condition of paralytic rabies, while in rabies by variant 2, the profile of predominant immune response is Th17, with shorter survival time and furious rabies.

Key words: human rabies, cytokines, variants, immune response, CNS

PI4o - Loss of Calbindin Expression in mice inoculated with rabies virus

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Introduction: The severity of rabies disease appears to be associated with dysfunction rather than structural damage of the nervous system. Therefore, it is important to study the effect of this viral infection on the metabolism of proteins such as those that regulate intracellular calcium levels. Calbindin (CB) is a calcium-binding protein and its concentration in the cerebellum is the highest in the CNS, especially in Purkinje cells. We had previously demonstrated loss of immunoreactivity to CB in the cerebral cortex, striatum and spinal cord of mice inoculated with rabies virus (RV). However, this same effect was not observed in the cerebellum. **Objective:** To evaluate the expression of the CB gene and its protein in the cerebellum of rabies-infected mice. **Materials and Methods:** 28-day-old female ICR mice were inoculated with RV-CVS in the hamstring muscles. Control mice were inoculated with vehicle solution (Mock). Six days later, when the animals reached an advanced stage of disease, they were divided into three groups to extract their cerebellum and each one was processed separately by immunohistochemistry (IHQ), Western blot and RT-qPCR. **Results:** No qualitative or quantitative changes in CB immunoreactivity were observed when comparing sagittal cerebellar sections of mice inoculated with RV and their controls. However, decreased mRNA and CB protein expression were found in the cerebellum of infected mice. **Conclusions:** These results confirm CB loss in the CNS of mice inoculated with RV. However, in the cerebellum this effect is not detected by IHC, perhaps due to the high concentration of the protein in this structure. The loss of calbindin could be associated with the effect of rabies infection on calcium metabolism. On the other hand, CB loss could also affect the metabolism of the neurotransmitter GABA present in CB+ neurons.

Key words: Rabies, calbindin, calcium binding proteins, cerebellum, Purkinje cell

PI5o - Immunopathological changes in renal and urinary bladder tissues during experimental infection with a rabies virus antigenic variant 3

Livia Medeiros Neves Casseb[1], Sara De Souza Pereira[1], Cassia Nazare De Sousa Moraes[1], Erika Dayane Leal Rodrigues[1], Vinicius Pacheco Da Silva[1], Victor Gabriel Bastos Chaves[1], Roberta Nicole De Oliveira Mota[1], Jamille De nazare Magalhaes Dos Santos[1], Ranna Taynara Dos Reis Sousa[2], Adriana Maciel De Castro Cardoso Jaques[2]

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Rabies, a zoonotic disease, manifests as a rapid, progressive, and fatal viral encephalomyelitis. The current knowledge about the distribution and pathological characteristics of the rabies virus (RABV) within peripheral organs during infection is limited. Research indicates viral infection in extraneural organs, including the kidneys and bladder, hinting at alternative viral elimination routes, particularly through urine. Thus, this study aimed to identify morphological changes and lesions in the kidneys and urinary bladder throughout the course of experimental infection with antigenic variant 3 (VAg3) of RABV in BALB/c mice. Histopathological assessment employed Hematoxylin and Eosin (HE), Periodic Acid Schiff (PAS), and Masson's Trichrome (TM) stains. Additionally, RABV antigen immunostaining via Immunohistochemistry was conducted to analyze and quantify viral presence on various days post infection (DPI). Noteworthy kidney alterations encompassed edema in proximal and distal convoluted tubules, as well as glomeruli; interstitial inflammation; glomerular tuft atrophy; reduction in capsule and Bowman's space; tubular glycogen accumulation; thickening of Bowman's capsule; and interstitial fibrosis. Concerning the bladder, although signs of interstitial congestion, lamina propria edema, and inflammatory infiltrates were observed in the urothelium, these changes were present in both the infected and control groups. Hence, direct association with RABV infection remains uncertain. Immunostaining was consistently detected throughout infection, peaking on the 13th DPI in both tissues, particularly pronounced in the kidneys with substantial viral expression. Hence, the investigation reveals that RABV infection has the potential to inflict irreversible harm on the kidneys, highlighting the importance of understanding disease progression at the tissue tier. In terms of the urinary bladder, innovative methodologies are necessary to apprehend the complexities underlying immune response dynamics in the context of RABV infection.

Key words: Rabies, Histopathology, Immunohistochemistry, Kidney, Bladder

WEBINAR CATS

Web1 - RABIES IN FELIDS

CE RUPPRECHT[1]

1 AUBURN UNIVERSITY

As an acute, progressive, viral encephalitis with a global distribution, rabies has a broad range of hosts, encompassing all mammals. Among mesocarnivores, cats are significant vectors. Human cases after feline exposure are known on all inhabited, enzootic continents, except for Australia (where introduced cats are exposed to bat lyssaviruses, but no human cases from spillover via rabid cats have yet been reported). Felids represent an excellent example that although all lyssavirus reservoirs serve as vectors, not all vectors are reservoirs. Whether domestic or wild, felids are susceptible, and transmit lyssaviruses, but are not responsible for viral perpetuation, unlike bats, dogs, ferret badgers, foxes, mongooses, raccoons, skunks, etc. No distinct viral variants are characterized from cats to date. Little is known about rabies in wild felids compared to their domestic relatives. Occasional cases in wild felids include lions, sand cats, and tigers. One of the most common reports among wild felids from North America involves bobcats (Lynx rufus), that may viciously attack people and other animals. In countries where canine rabies has been eliminated, cats are a commonly infected domestic species. Domestic cats may be pre-disposed culturally for being at risk to lyssavirus infection because they may be ignored for vaccination. Moreover, responsible cat ownership involves proper supervision, and not letting cats roam, where they may encounter rabid predators and prey. In canine enzootic countries, a conundrum exists, when cats are presented by the public for primary vaccination, but resources are inadequate for even routine dog coverage. Program managers should ensure that dogs are a priority, but that other domestic species at risk, such as cats, will also be vaccinated where biologics are not limited. Although safe and effective programs for oral vaccination of wild carnivores target a range of species, this does not include cats. Once rabies has been effectively controlled, prevented, or eliminated from dogs or wild mesocarnivores, cases in cats are predicted to diminish. However, the risk of infection will remain to cats and other taxa because of the reality of bat lyssaviruses on a global basis.

Web2 - Rabies in cats in Colombia

Luis Carlos Gómez[1]

1 National Health Institute - Colombia

Rabies in cats in Colombia has become a public health challenge. Human behavior has been changing and people have fewer children and more pets. Nowadays cats are common pets, and we must understand their behavior. Rabies is transmitted through the bite of infected animals, so surveillance systems have focused on treating patients who were attacked by potentially infected animals to eliminate the urban cycle of rabies with the transmission of the lineage whose reservoir is the dog. However, the wild cycle, whose main reservoir is bats, has become the greatest challenge for surveillance due to the different species that have contact with these bats.

Some cases of rabies in cats in Colombia from 2018 to 2023, its forms of transmission and clinical and epidemiological characteristics are presented. In addition, it is observed how the cat is a bridge between bats and humans in the wild cycle. The characteristics of the cat that have created a bridge between bats and humans are due to its feral behavior and hunting instinct. Cats are animals that seek prey far from home and can become infected by bats that have rabies. For this reason, control and prevention programs could consider incorporating into their action plans risk communication about annual vaccination of dogs and cats and that in cases of aggression by potentially rabies-transmitting animals, people should consult health services in a timely manner.

It is necessary to consider that the analysis of the history of aggression by medical personnel is of vital importance since it allows guiding the treatment and ruling out a possible rabies exposure. Also, veterinarians in their clinical practice should consider that any neurological syndrome in dogs and cats regardless of their age may be probable cases of rabies, so directing the owners of these animals to the health services will mitigate the risk of presenting a case of human rabies.

Key words: Rabies, Cats, Surveillance, Pets, Treatment

Web3 Rabies in Cats in Brazil

Silene Manrique-Rocha[1]

1

In Brazil, many of the public health problems related to urban rabies have been solved. However, the control of urban rabies remains paramount, as controlling it in its wild form is almost impossible, given the intense circulation of this form throughout the country. Even though the decrease in human rabies caused by dogs and canine rabies is evident in the country. Recently, more than 90% of human cases are caused by bat variants, either by direct involvement or by cats with bat variants. Domestic cats have been considered a high-risk species for the transmission of rabies to humans. In Brazil, the cat population is possibly more numerous than the dog population. However, the behavioral aspects of cats have a direct impact on bat predation and the consequent spread of rabies can occur much more quickly, due to the large number of cats, especially in large urban centers. Between 2000 and 2022, of the 206 human rabies cases recorded in Brazil, 41.7% (86/206) were caused by dogs, and 51.9% (107/206) were diagnosed with Agv3 variants from bats. Of these, 91.5% (98/107) were transmitted directly by bats and 4.7% (05/107) by cats. In the same period, 402 domestic cats were diagnosed positive for rabies and, of the samples that could be tested for genetic lineage, around 10% were found to have bat genetic lineage. From 2000 to 2022, of the 206 human rabies cases recorded in Brazil, 41.7% (86/206) were caused by dogs, and 51.9% (107/206) were diagnosed with Agv3 variants from bats. Of these, 91.5% (98/107) were transmitted directly by bats and 4.7% (05/107) by cats. In the same period, 402 domestic cats were diagnosed positive for rabies and, of the samples that could be tested for genetic lineage, around 10% were found to have genetic lineage from bats. Human rabies caused by cats with detection of AgV3 arises as a result of new dynamics of interaction between bat species and other mammals with the rabies virus, possibly established from the disruption of the ecological balance. We can say that with the control of canine rabies, we have a leading role for rabies in bats and its spillover, showing a change in the epidemiological profile of this disease in the country. Several factors may be associated with the change in the epidemiological profile and the increase in rabies cases in humans caused by cats and bat variants. One of them is the adaptation of bats to urban areas: deforestation, fires, ease of movement, real estate expansion, among others, are attractions that bring these animals closer to cats and dogs in cities. Another example could be the population's lack of knowledge about rabies vaccination for domestic cats, as well as the difficulty in vaccinating these animals in campaigns. As well as the lack of knowledge about human prophylaxis when bitten by cats. The proximity between humans and bats in urban and rural environments must be understood as part of a broader context of environmental management, in order to analyze the constant ecological transformations and consider the dynamics of the productive factors and processes at work. In addition to strengthening the vaccination of cats.

Web4 Should we worry about rabies in cats? – A northern Americas perspective

Christine Fehlner-Gardiner[1]

1

In Canada and the United States, rabies cases are most frequently detected in wildlife – bats, skunks, raccoons and foxes. Neither country is enzootic for canine rabies virus variants, and there are no variants known to circulate independently in cat populations. Despite that thousands of cats are tested for rabies each year, a relatively small percentage are found to be infected. Human rabies cases caused by exposure to a rabid cat are exceedingly rare. Taken together, these observations might suggest that for Canada and the US, rabies in cats should be a minor concern, but they do not tell the whole story. This presentation will provide an overview of ownership trends, vaccination rates, epizootiology of rabies, and other factors to consider when assessing how much importance should be placed on rabies in cats in the northern Americas.

Web5 Epidemiology of cat rabies in Asia

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2 Programme Officer, World Organization for Animal Health, Sub-Regional Representation for Southern Africa, Gaborone (Botswana)

Abstract: Dogs are the main reservoir of the rabies virus, and dog bites are the primary source of human rabies exposure in Asia. The occurrence of rabies in domestic cats (Felis catus) is less commonly reported than in domesticated dogs in Asia. Human rabies cases associated with domestic cat exposures are rare. Nevertheless, it's important to note that the comprehensive understanding of the role of cats in the epidemiology of rabies is limited, and further research and study are needed to provide a clearer picture of their involvement in the transmission of the virus. We analyzed cat rabies data in Asia using the World Animal Health Information System (WAHIS) database and observed that cat rabies cases are reported more frequently in West Asian countries compared to South and Southeast Asian countries. This observation highlights regional variations in the prevalence and reporting of this disease, but this could also be due to differences in surveillance and reporting systems. Strengthening surveillance of cat rabies is crucial not only for understanding the transmission dynamics within the cat population but also for assessing the potential spillover of the virus from dogs to cats. This proactive approach can save lives, both human and feline, and contribute to the overall control of rabies in Asia and beyond In Asia, rabies vaccination campaigns primarily focus on domestic dogs, but cats are also vaccinated against rabies as part of the rabies elimination program.

Web8 - Rabies biologics for cat vaccination

Joanne Maki[1]

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Objective: To provide insight into the manufacture of commercial feline rabies vaccines. In the United States (US), as in other countries, controlling and eliminating dog rabies was a priority to minimize human exposure to this deadly disease. Mandatory dog vaccination program led to a decline in canine cases and eventual elimination of the canine variant from the US. Afterwards, wildlife rabies variants emerged and rabies, as a disease in domestic cats, became a public health topic of concern. Although domestic cats are not a true reservoir for the rabies virus, they are a common spillover host. Factors that increase human exposure risk to rabid cats include easy access to unvaccinated young kittens, the rehabilitation of injured cats, and domestic cats' hunting behavior. Killed rabies virus vaccines initially developed for dogs were successfully adapted for use in cats. During the 1990's feline injection site sarcomas (FISS) were identified and linked to the use of classically adjuvanted feline leukemia and rabies vaccines. Due to the importance of preventing rabies in cats, vaccine manufacturers responded to this concern. The availability of an adjuvant-free rabies feline vaccine was an important advancement not only to reduce the risk of FISS but to also ensure that cat owners would continue to vaccinate against rabies. As cats continue to gain in popularity as pets not only in the US but also globally, the use of safe and effective rabies vaccines will remain an important part of feline health.

Key words: vaccines, cats, safety, public health

POSTERS PRESENTATIONS

HUMAN RABIES AND PROPHYLAXIS

HP9p - Human rage in Oaxaca generates panic in the City of Puebla

Eduardo Carlos Bautista Lozano[1]

1 Secretaria de Salud

Human rage in Oaxaca generates panic in the City of Puebla Author: Master. Eduardo Carlos Bautista Lozano Public Health Laboratory of the State of Puebla.

Introduction: The news at the end of the year 2022 about the cases of rabies in two children due to aggression by bats in the State of Oaxaca, generated panic in the City of Puebla, the presence of bats in different parts of the city contributed to that fear. **Objective:** To carry out an analysis of the results obtained from samples studied to diagnose rabies in bats in the City of Puebla during the last 25 years and determine the risk of human rabies from this species. **Materials and methods:** Given the presence of human rabies in the State, the Rabies Laboratory was created in 1997 in the State Health Services, establishing the study of 100% of samples from aggressor animals, suspects and contacts, 10% of what was captured in raids, 100% of samples of rabies foci and monitoring the aerial and wild reservoir with samples of animals found run over on the roads and captured in areas of hematophagous bats. In the City of Puebla, insectivorous bats found by citizens or removed by firefighters at the request of citizens are monitored. **Results:** During 1997-2022, 122,715 samples have been processed, with 915 canids, 58 bovines, 42 bats, 35 other species and 10 humans being positive. Of the positive bats, 5 are insectivorous from the City of Puebla. The 10 human positives were V-1. **Conclusions:** The biogeographical conditions of the City of Puebla determine the presence of non-hematophagous bats only, their positivity has been low, however, it is recommended not to touch them due to the risk of transmitting rabies, promoting their protection due to the role they play in the ecosystem.

Key words: Bat, Puebla, Rabies, Monitoring, Transmission

HP10p - Indication and use of vaccine, serum and anti-rabies immunoglobulin in 2022 in the Federal District / Brazil

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Introduction: The main form of prevention of human rabies is post-exposure prophylaxis, which includes washing the wound with soap and water, observing the offending animal and administering immunobiological, whose indication depends on the exposure, the characteristics of the wound, the species and condition of the offending animal. With the Ministry of Health protocol change in 2022, we observed a decrease in immunobiological indications and an increase in the indication of animal observation. There were also more indications for the use of vaccine and serum for accidents with wild animals or dead or missing dogs and cats. **Objective:** To describe and evaluate the prescribed quantity of anti-rabies vaccine, serum (or immunoglobulin) in the Federal District (DF) in 2022. **Materials and Methods:** Descriptive, retrospective study, based on anti-rabies care data extracted from the System of Information on Notifiable Diseases (SINAN). **Results:** In 2022, in the DF, 14,438 cases of anti-rabies care were reported versus 12,430 in 2021. Of these, 2642 (18.3%) had indication of observation and vaccine, 3320 (23%) indication of serum (or immunoglobulin) and vaccine, 2310 (16%) indicated vaccine and 4981 (34.5%) animal observation. There were changes in the indications in relation to the year 2021, which were 7172 cases of Observation and vaccine (57.7%), 1963 (15.8%) of serum and vaccine, 1504 (12.1%) of vaccine and 919 (7.4%) from animal observation. **Conclusion:** The number of anti-rabies consultations in the DF has maintained a certain constancy in recent years, however, we have seen an increase in the indication of animal observation and the prescription of serum and vaccine in 2022 compared to 2021, possibly due to the case of Human Rabies in the DF in the said year. The indication of post-exposure prophylactic treatment, combined with extensive vaccination of domestic and farmed animals, are fundamental strategies for controlling the disease.

Key words: Rabies, Public health, Serum, Vaccine, Immunoglobulin

HP11p - First Report of human rabies outbreak in an indigenous village -Minas Gerais' Brazil' 2022

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Introduction: On April 4, 2022, the Ministry of Health was notified of a suspected case of human rabies in an indigenous child in Bertópolis, Minas Gerais. In the following days, other suspected cases were reported among children of the same ethnicity. Rabies is an acute viral infectious disease that affects mammals, including humans, with a high lethality rate. Treatment with antivirals and deep sedation, known as the Recife Protocol, is recommended

in Brazil. **Methods:** Case report' April 2 to June 10, 2022' with secondary data from medical records' results of diagnostic tests and genetic sequencing. Epidemiological information on possible exposure was obtained from reports by researchers and indigenous authorities. A confirmed case was defined as a villager with compatible symptoms and a positive laboratory test result for the rabies virus. **Results:** Four cases of human rabies were confirmed - two males and two females - aged between 4 and 12 years. All evolved to death. Two suspected cases were discarded. Sequencing of the laboratory samples from two cases identified lineage 3 of the rabies virus (two cases had insufficient samples). The interval between the first clinical signs and death varied from 2 to 24 days; the symptoms common to all were: dyspnea' fever' prostration' sialorrhea' tachycardia and distended abdomen. The treatment of one case with the Reef protocol during the prodromal period resulted in the longest survival (24 days). **Conclusions:** The investigation confirmed the occurrence of a rabies outbreak with high lethality. This is the first recorded outbreak of the disease in an indigenous population in Brazil. There are reports of aggression and injuries compatible with a defensive bite from a non-haematophagous bat in two children. It is suspected that the exposure occurred as a one-off event. Residents received pre-exposure prophylaxis with two doses of vaccine. Cats and dogs were vaccinated and health education activities were carried out in the area.

Key words: Hydrophobia, Lyssavirus, Zoonose, Raiva, morcegos

HP13p - Traditional healers matter in One Health Approach to Rabies Control in Bangladesh

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Rabies is a zoonotic viral disease that has huge impact on human and animals in Bangladesh. According to the Ministry of Health and Family Welfare, there are 4 million people seek for rabies vaccine each year due to dog bites which indicates a significant risk of rabies to the country. Not to mention the fact, many dog bite victims (59%) visit traditional healers to receive primary treatment rather than going to a hospital. Traditional healers offered treatment comprises the use of oils, salt, herbs, red chilies on dog bite wounds and eating medicated bananas (locally called as "Kola Pora") and drinking water (locally called as "Pani Pora"). But they are often neglected and left out from 'Rabies Prevention and Control Program in Bangladesh. They don't know the importance and value of immunization and thereby contribution to the prevention and control of Rabies. As there are persisting myths and false beliefs on traditional healers regarding the management of dog-bite cases among people with low socioeconomic status in rural areas, so it is crucial to implement an outreach communication initiative to engage and educate traditional healers on rabies prevention measures in both animals and humans. This will be a way where they can learn about rabies, its infectiousness and the importance of early PEP and dog vaccination in controlling the disease, both in dogs and humans. This effort aims to reduce the number of human rabies cases and deaths in Bangladesh by educating and motivating traditional healers and improving dog vaccination coverage and collaborating with multi-sectoral partners to achieve a rabies-free country by 2030.

Key words: Traditional Healers, Rabies, Awareness, Control, Banglades.

HP15p - Case Study about rabies transmitted to humans in Oaxaca

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Introduction: The hematophagous bat Desmodus rotundus is the main carrier and transmitter of rabies to cattle in Mexico and eventually to humans. **Objective:** To analyze and point out the facts occurred in a case of rabies transmitted to humans in Oaxaca' as well as the actions carried out. **Materials and methods:** The facts were followed up and the area of interest was delimited based on the guidelines of NOM-067-ZOO-2007. The Ministry of Health carried out rabies vaccinations for pets. CEFPPO A.C. carried out rabies vaccinations for domestic livestock, and implemented operations to capture hematophagous bats in corrals near the affected population. To determine if the captured specimens were positive for rabies, the direct immunofluorescence test (DIF) was performed. **Results:** As part of the containment work in the area of influence of the outbreak. Hematophagous bats were captured in 12 sites in the focal zone. A total of 23 common vampire bats were captured' 16 were treated with vampiricidal ointment in accordance with the guidelines of NOM-067-ZOO-2007. Of these' seven were sent for diagnosis at the Oaxaca State Public Health Laboratory (LESPO). None of the samples were positive for rabies by IFD. Conclusions and/or recommendations: It is necessary to identify priority areas for attention. Hematophagous bites are a problem that needs to be dealt with promptly and efficient communication channels should be established for their attention. This will avoid disturbing refuges where there is no certainty of the presence of Desmodus and which could affect other species as well as the ecosystem services they provide.

Key words: zoonoses, public health, bats direct, immunofluorescence (DIF), Rabies in humans

HP16p - Human Rabies in an Indigenous Community in Brazil: A One Health Approach

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Introduction: Between April 2 and June 10, 2022, 4 cases of human rabies were confirmed in indigenous children of the Maxakali ethnic group. Of these, 2 had lesions compatible with a non-hematophagous bat bite, probably in a single event in which the children handled the animal. In this context, a public health investigation was undertaken. Objectives: To investigate an outbreak of human rabies and propose intervention measures based on the one health concept. **Methods:** Intersectoral action between April and June 2022 in communities of the Maxakali ethnic group, Minas Gerais, Brazil. The action included epidemiological and environmental investigations and surveillance actions, and involved the Minas Gerais Agricultural Institute, the Health team of the Special Indigenous Health District, the Municipal and State Health Departments, FETP-Brazil and the Ministry of Health, with the support of local leaders. As a source of data, death certificates were consulted between January 2019 and April 2022 to search for possible previous cases of human rabies. **Results:** the actions included visits to the health units that treated cases, health education, animal and human anti-rabies vaccination, investigation of reports of animal spoliation, deaths of animals or animals affected by neurological syndromes in the village and on five surrounding rural properties, as well as a search for bat shelters. During the period analyzed, there were 55 deaths, and no previous cases with symptoms compatible with human rabies were identified. The local care network was visited and care flows for suspected cases were established, contributing to timely diagnosis and care. The community, village teachers and religious leaders took part in the health education activities. In conversation circles, participants were encouraged to learn about the disease and transformed their impressions into drawings which served as the basis for creating information material in the Maxakali language. Out of 2,500 individuals, 2,416 received pre-exposure prophylaxis for human rabies. The dogs and cats present in the village (N=294) were vaccinated, and guidance was provided on the importance of vaccinating herds, avoiding handling animals with neurological signs and not coming into contact with bats. Producers reported no suspected cases of rabies in animals in recent years. Deforestation and the presence of rock formations, caves and tunnels were observed. A disused mine was home to colonies of insectivorous bats and *Desmodus rotundus*, for which control was carried out.

EPIDEMIOLOGY AND SURVEILLANCE

ES10p - the history of rabies in Brazil

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Rabies is a fascinating chapter in the history of science and medicine walking with humanity since antiquity. In all countries around the world, rabies has a long and interesting history. In this book, we dedicate ourselves to study more deeply the history of rabies in Brazil. Many questions arose d and guided us during the study. Did the Brazilian indigenous people already know rabies? If yes, how was the disease viewed and treated by their culture. How was rabies treated and prevented in the Brazilian colonial and imperial period? Which ani-

mals were involved in the rabies cycle at that time? And what about the bats, what did people know about them and their role in rabies transmission? Were bats already a rabies virus reservoir when the Europeans arrived in Brazil or was the disease introduced by colonization? How was the relationship between humans and bats in the 16th, 17th and 18th centuries? What was the reaction of Europeans towards hematophagous bats? The answer to these questions were obtained in the reports of "naturalists" during their trips through Brazilian lands, describing in details the fauna, flora, routine and behavior of indigenous peoples. Laws, medical journals, newspapers and any type of publication from the time when the disease was still called hydrophobia and microbiology was still contested by science were also consulted. We find descriptions of miraculous recipes and curious procedures for its cure, such as subjecting the patient to high temperatures and excessive sweating, the use of mercury, electric currents, opium, curare, cocaine, strychnine and many other "medicines". Our research also describes the history of the rabies occurrence and human and animals, the history of Pasteur Institutes in Brazil and the role of research institutions in the production of vaccines, the study of the etiological agent and the disease control.

Key words: Brazil, rabies history, bats, rabies occurrence, rabies control

ES11p - Survey of the genetic lineage of the rabies virus in samples from the municipality of Crateús - CE in the year 2017

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Rabies is an anthropozoonosis that affects the central nervous system of mammals with a mortality rate of almost 100%. Transmission occurs when the viruses present in the saliva of the infected animal penetrate the organism through the skin or mucous membranes, through biting, scratching or licking. This descriptive study was carried out in the municipality of Crateús, which is a Brazilian municipality in the State of Ceará. Data were collected from examinations of samples from the cerebellum, trunk and cortex of suspected animals sent to LACEN – Fortaleza, where the polymerase chain reaction technique preceded by reverse transcription (RT-PCR) was performed, which is a fast, sensitive and specific methodology, offering a high level of sensitivity. The amplicons obtained underwent sequencing and subsequent genetic analysis, facilitating the identification of the origin of the virus in routine diagnosis and the epidemiological relationship between the different species. In 2017, eleven samples were sent, two from foxes, seven from cattle and two from sheep. With regard to samples from foxes, the virus from the wild canine lineage was detected and all RABV samples from cattle and sheep showed a genetic lineage characteristic of hematophagous bats D. rotundus. These results demonstrate the circulation of the virus in herbivores and wild animals in the interior of the state of Ceará, emphasizing the direct risk to Unique Health. It is concluded that it is necessary to invest in preventive measures, such as control of the hematophagous bat population and the application of the annual vaccine to the entire flock, regardless of age, in addition to epidemiological studies that help in the development of strategies for the control of herbivorous rabies and in the wild environment.

Key words: Rabies, Crateús, virus, epidemiological, lineage

ES12p - Spatiotemporal analysis of bovine rabies and associated risk factors in Brazil's most highly incident states (2010-2019)

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After highly successful canine elimination campaigns, Brazil has observed a shift in the epidemiological profile of rabies, whereby bats have become increasingly important in the transmission process. This has resulted in a significant livestock rabies burden attributed to vampire bats (Desmodus rotundus), which feed preferentially on cattle. The primary objective was to investigate the spatiotemporal distribution, identify hotspots and quantify associated risk factors driving bovine rabies notifications in the most incident states of Brazil. To achieve this, we performed a descriptive analysis, clustering analysis and developed a conditional autoregressive (CAR) model for each of the most incident states. The 5 states with the highest bovine rabies incidence over the study period (2010-2019) were Minas Gerais (n =1,136), Rio Grande do Sul (n =748), São Paulo (n =629), Paran›n =571) and Mato Grosso (n =491). We found no evidence of seasonality of bovine rabies incidence and all states other than São Paulo showed evidence of spatial clustering. The results of our CAR model indicated spatial non-stationarity and that the predictors associated with the spatial variation of bovine rabies incidence in Brazil varied in quality and quantity across the different states. The relative risk of bovine rabies incidence was positively associated with the presence of C3 perennial crops in Mato Grosso, temperature in Paran.

Key words: Bovine rabies, Cattle, CAR model, Surveillance, Brazil

ES13p - Patterns of dog attack injuries and health-seeking delays in rural and urban communities of Zambia (2020 – 2021)

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Background: The public health significance of dog bites includes the risk of rabies, injury, and healthcare costs. Understanding its epidemiology and characteristics of the bite injuries are key to developing targeted interventions. However, dog bites in Zambia are not properly described. The aim of this study was to profile dog bite injuries in human victims in urban and rural communities in Zambia. **Methods:** This was a cross-sectional study design with primary data collated using a newly designed dog-bite form in an urban and a rural (Lusaka and Mkushi) district in Zambia. The data was entered in EpiData. Descriptive analysis was used to characterize dog bite incidences and distribution across the victims. The profiling of dog bite cases was described using frequencies, percentages and means. **Results:** There were 567 dog bite cases with 71.4% been from Lusaka district and 40.2% of the victims were from low social economic status. Males were 56.1% affected than females and 51.2% affected were adolescence under 19 years old. The time of incidence occurrence was mostly in the morning (36.4%) as compared to afternoon (29.5%), evening (29.9%) and night (4.5%). 78.3% victims were referred for Post Exposure Prophylaxis (PEP). Most of the dog's ownership was known (84.1%) with only 15.9% unknown, although only half of the dogs were vaccinated against rabies. Health-seeking for puncture wounds was the latest when the wound occurred on the legs (3.4 days) and arms (3.3 days). However, health care was sought the earliest for puncture wounds occurring on the head and neck (0.9 days). The attributed trigger for dog attacks were mostly offensive. **Conclusion:** The findings can be used to identify at-risk sub-group populations and develop targeted cost-effective and sustainable dog bites preventative interventions in Zambia. In addition, it will help improve risk assessment in dog bite case management.

Key words: Rabies, dog bite, wounds and injuries, health behavior, Zambia

ES14p - Rabies in Canada – 2022

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Introduction: The laboratories of the Canadian Food Inspection Agency (CFIA) perform diagnostic testing for human suspect cases, and animal suspect cases where the animal has exposed persons or domestic animals. Certain provinces also conduct testing for enhanced wildlife surveillance (EWS). The majority of rabies cases are found in wildlife, with main reservoirs being arctic fox, striped skunk, racoon and multiple species of insectivorous bats. **Objective:** To describe the epidemiological situation of rabies in Canada in 2022, based on laboratory-confirmed cases teste at CFIA laboratories or reported to CFIA. **Materials & Methods:** Animal samples were tested at CFIA using direct fluorescent antibody test (FAT); human samples were tested by FAT and/or quantitative RT-PCR. Variant typing was performed using panels of discriminatory monoclonal antibodies or sequencing of the N gene. Testing of EWS samples was by conventional immunohistochemistry (IHC) or the direct, rapid immunohistochemical test for rabies (dRIT). **Results:** CFIA tested 2535 samples, 72.6%

were from animals with a history of human exposure, 17.8% had only domestic animal contact and 9.5% had no documented contact. Of the 136 (5.4%) that tested positive, 29 (21.3%) were EWS samples. Six bat cases positive on IHC were reported but not submitted for confirmation. Samples from 6 human suspect cases were all negative. Rabies caused by raccoon variant virus (RVV) was detected in Ontario (n=25; a 79% increase from 2021) and New Brunswick (n=2), and 40 cases due to artic fox variant were detected across northern Canada, an increase of 233% from 2021. Bats accounted for the highest proportion of wildlife cases (56, 41.2%), followed by foxes (32, 23.5%), skunks (28, 20.6%), and raccoons (7, 5.1%). Among domestic animals, rabies was detected in 10 dogs, 2 horses, and 1 bovine; the result of spill-over of AFVV in northern regions (8 dogs), and skunk-variant virus in western Canada (1 dog, 2 horses and 1 bovine). An imported dog was infected with a Middle East canine variant virus. Although most rabies cases were in wildlife species (123/135, 90.4%), domestic species accounted for 45.7% (1158/2535) of specimens analysed. **Conclusions:** RRV remains a concern in the Niagara region of Ontario, and also re-emerged in New Brunswick during 2022 after being undetectable since 2019. The AFVV outbreak in the north has accelerated and spread across the entire region in 2022. This increase in RVV and AFVV cases accounts for the increase in rabies case detection during 2022 compared to 2021. The detection of imported canine rabies cases in 2021 and 2022 was one driver of revisions to import requirements for commercial dogs over 8 months of age.

Key words: Rabies, surveillance, Canada, outbreaks, imported cases

ES15p - Evaluation of a new tool for case closure timely anti-rabies care in the Federal District, Brazil

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Introduction: In Brazil, all accident care per animal potentially transmitting rabies must be notified by the services in the Notifiable Diseases Information System (SINAN). The closure of the case must be carried out within 60 days of notification. However, we realize a high number of cases not closed or closed out of time advocated, which impacts on data analysis and actual monitoring of exposed patients. **Purpose:** To describe and evaluate the effectiveness of a strategy adopted by the Epidemiological Surveillance and Immunization Center team (NVEPI) of the Central Health Region of the Federal District (DF), for the purposes of timely closure of cases of anti-rabies care. **Materials and Methods:** Descriptive study, experience report type, from a strategy to facilitate the flow of timely closure of cases. Created at the beginning of 2023, the strategy consists of weekly extracting data from SINAN's anti-rabies service, and sending it to the Basic Health Units (UBS) of reference through an automated table with alerts (closing the case) for closure of forms in a timely manner. **Results:** Only in the first half of 2023, we had a total of 879 cases in the Central Region, 687 of which closed cases (78.2%) compared to 589 (78.6%) of a total of 749 cases in the first half of 2022. Timely closure was 656 cases (74.7%) in the first semester of the current year versus 334 (44.7%) in the first half of 2022. **Conclusion:** The closure of anti-rabies service notifications has always been a great challenge for all surveillance. Even in the case of a preliminary analysis, we can evidence a significant improvement in timely case closures, showing that the tool used proved to be quite efficient for being dynamic and interactive with the professional, contributing to the improvement of work processes in user assistance.

Key words: Epidemiological Monitoring, Rabies, Zoonoses, Attention Primary to Health, Public Health

ES17p - Epidemiological Characterization of the Rabies Event in Valle del Cauca 2018-2021

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Abstract introduction: Rabies is a zoonotic disease caused by a virus of the Lyssavirus genus, Rhabdoviridae family. The virus is commonly transmitted through the bite of an infected mammal, including domestic and wild animals. Transmission can occur through saliva, injured skin, or contact with mucous membranes. In Latin America, the hematophagous bat has been identified as the main transmitter of the disease, followed by domestic canids. **Objective:** To determine the risk of human rabies cases occurring in 40 municipalities in the department of Valle del Cauca during the period 2018 – 2021. **Materials and methods:** An epidemiological ecological study was conducted, analyzing indicators of post-exposure treatment for individuals attacked by potentially rabies-transmitting animals (APTR), viral identification in humans, companion animals, wildlife, and production animals, useful vaccination coverage (≥ 80%) in companion animals, and laboratory-based rabies surveillance. The information from the variables was consolidated in the Human Rabies Risk Stratification Matrix (MERRH) of the National Institute of Health (INS). **Results:** The results obtained for the period 2018 - 2019 indicated that 26 municipalities had a high risk of a human rabies case occurring, and 14 municipalities had a medium risk. For the period 2020 – 2021, 20 municipalities presented a high risk of a human rabies case occurring, and 20 municipalities had a medium risk. For the overall analysis of the Valle del Cauca department, a high-risk stratification was found with 75% exposure to the risk of a human rabies case occurring during the period from 2018 to 2021. **Conclusion:** Based on the results obtained, it was concluded that the highest risk of the department presenting a human rabies case was associated with incomplete post-exposure prophylaxis indicators for APTR, followed by vaccination coverage in companion animals.

Key words: virus, risk, rabies, vaccination, risk stratification

ES18p - Epidemiological analysis of the accident caused by animal potentially transmitting the rabies virus in Fusagasugá, Cundinamarca, Colombia between 2020 and 2022

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Accidents due to the bite of animals potentially transmitting the rabies virus are caused by the aggression of an animal that may or may not be carrying this virus. Rabies is a zoonotic viral disease, transmissible between animals and humans. If not treated correctly, it can be fatal, but it is preventable. **Objective:** To develop an epidemiological analysis on the accident due to an animal potentially transmitting the rabies virus in Fusagasuga, Cundinamarca, Colombia during the period from 2020 to 2022. **Materials and methods:** The epidemiological study was carried out in the municipality of Fusagasuga, Cundinamarca, Colombia, 1145 records of event 300 were verified, which are generated with the report of people attacked by animals potentially transmitting the rabies virus, in order to have knowledge of how many cases of attacks occurred and also to know which were classified as mild, serious and as non-exposure. **Results:** In the annual periods 2020, 2021 and 2022, 1,145 reports of attacks were recorded, the majority by the canine species (84.97%; n = 973), without a specified breed (62.44%; n = 715), without be classified as special management dogs (SMD) (78.51%; n = 899), without annual vaccination (n = 581), the highest proportion of observable animals (67.51%; n = 773), without being in street condition (63.75%; n = 730), generating mostly single lesions (835 cases), mainly located in the lower limbs (433 cases), mainly classified as "No exposure" (66.28%) and mainly presenting in the months of March (120 cases) and February (119 cases). The corresponding attacks mostly occurred in the age group >51 years (23.58%; n = 270), in the male gender (53%; n = 602). **Conclusion:** Reports of attacks by an animal potentially transmitting the rabies virus are generated mainly by factors that characterize both the aggressor animal (species, breed, SMD, vaccination, observable or unobservable, street condition) and the attacked person (sex, age, place of residence).

Key words: bite, scratch, rabies virus, transmission, exposure, indicators, epidemiology.

ES19p - Behavior of aggressions by potentially rabies-transmitting animals in six localities of Bogotá during the period 2019-2020

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Introduction: Aggression by potentially rabies-transmitting animals is a notifiable event. In Colombia, the National Institute of Health recommends the analysis of the information resulting from the event in terms of follow-ups and observations of aggressive animals with the environmental health area of the territorial health entities, in order to properly classify the cases and provide timely

management of the assaulted persons. For 2018, 21,795 cases were reported in Bogota, with an incidence rate of 265.8 cases per 100,000 inhabitants. **Objective:** to characterize aggressions by potentially rabies-transmitting animals (event 300) in six localities of Bogotá (Santafé, Mártires, Candelaria, Rafael Uribe Uribe, San Cristóbal and Antonio Nariño), during the period from September 2019 to September 2020. **Methodology:** Through the analysis of the database (event 300), provided by the team of transmissible events of zoonotic origin of the Subred Integrada de Servicios de Salud Centro Oriente E.S.E., a retrospective descriptive study was carried out identifying the variables of interest to characterize the surveillance of the event. **Results:** A total of 1688 aggressions were reported and 1802 follow-ups were carried out on the aggressor animals, 84.6% (n=1525) were caused by canines and 15.4% (n=277) by felines. The 85.5% were bites. In 86.7% (n=1563) it was possible to observe the animal or animals involved. Regarding rabies virus exposure, 86% (n=1459) of the aggressions were classified as no exposure, 8% (n= 134) as severe exposure, and 5% (n= 80) as mild exposure. The highest incidence of the event occurred in the Santafé locality. **Conclusion:** 87% of the follow-ups were effective, which indicates that most of the information provided by the Primary Data Generating Units (UPGD) together with the activities between areas made it possible to make observations and subsequently classify them as non-exposure.

Key words: Aggression, Rabies, Domestic animals, Pets, Exposure

ES20p - A cross-sectional appraisal of knowledge, attitudes, and practices towards rabies: A preliminary approach in Colombia

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Introduction: Rabies virus infection causes a fatal brain disease in mammals and any species is susceptible to infection. Any effort aimed at recognizing infected animals and the first actions in the event of transmission, is mandatory. **Objective:** To determine knowledge, attitudes, and practices (KAP) profiles regarding rabies in a municipality of Colombia, using multiple correspondence analysis (MCA). **Material and methods:** A descriptive observational study was carried out in 71 pet tutors domiciled in the tutelary hills of Ibagué (Tolima, Colombia), owning at least one dog and one cat. A questionnaire-based survey collected data on rabies KAP as well as demographic information. Data analysis involved descriptive statistics and MCA. **Results:** The population of study were domiciled in Pan de Azúcar (28.2%), La Martinica (26.8%), Cerro Gordo (23.9%), and Noroccidentales (21.1%) tutelary hills. A significant proportion of the participants resided in urban areas (67.6%), the median age was 46 (31.5-57.5), and were mainly females (74.6%). Most participants had either a middle (high school; 46%) or basic education (primary and non-formal; 35%), while a smaller proportion had a higher education (graduate; 18%). Most households had either one (54.9%) or two (28.2%) inhabitants. The study revealed a commendable level of rabies awareness among the urban residents of study. However, concerns included the entrance of stray animals into homes and a lack of awareness regarding reporting deceased animals. Respondents demonstrated a correct approach to bite management and wound cleaning, and a strong need for more information to enhance their knowledge and awareness of the disease. Clear profiles could not be determined due to the clustering of variables. **Conclusion:** These findings provide valuable insights to improve rabies prevention efforts and promote public health. Health education, evidence-based strategies, and community participation are essential for successful disease control, as well as addressing educational gaps, considering sociocultural factor.

Key words: Attitudes, clustering, Colombia, health knowledge, Practice

ES21p - Laboratory surveillance of rabies virus associated with human risk between 2010-2023

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Rabies is one of the major zoonoses of public health interest. As a disease under the International Health Regulations, surveillance of the virus in humans and domestic and wild animals that pose a risk to human health is a priority and is under the responsibility of the National Reference Laboratory for Virology (LNR) in coordination with the National Laboratory Network under an immediate and mandatory notification system. Here, we describe the findings of laboratory surveillance of the rabies virus in Colombia from 2010 To 2023, conducted by the LNR Virology of the National Institute of Health (INS).The Samples notified from the territories were processed for viral confirmation by detection of antigens, viral genome, viral isolation in suckling mice, and genetic characterization of variants by phylogenetic analysis, under the international guidelines of the World Health Organization. Historical data from laboratory surveillance were consolidated from the INS Virology Group databases. In total, 5,183 virological surveillance results were obtained. Sample notifications corresponded to 68.7% of dogs, 19.9% of cats, 9.2% of bats, 0.5% of foxes, 0.6% of humans, and 0.9% of other mammals. The positivity rate was 0.9%, including deaths. The Magdalena department had the highest number of positive cases in foxes and dogs related to cosmopolitan genetic variant foci. In the Andean region of the country, the non-hematophagous bat variant and the hematophagous bat variant co-circulate, highlighting the Huila department where the last two cases of human rabies due to this last variant mediated by cats have occurred. Laboratory surveillance allows for the characterization of rabies virus circulation in the country. It is necessary to unite the efforts of various stakeholders with active surveillance under a one-health approach to better understand its transmission dynamics and persistence.

Key words: Surveillance, Rabies Virus, Human risk, Colombia, Public health

WILDLIFE RABIES CONTROL

WR8p - Oral rabies vaccine bait uptake by target and non-target species in developed areas of Tennessee, 2021-2022

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Introduction: Oral rabies vaccination (ORV) is used to prevent the spread of raccoon (Procyon lotor) rabies virus variant in the eastern United States (US). However, post-ORV rabies antibody seroprevalence among target raccoon populations remains variable and is reportedly lowest in developed areas, raising questions about bait availability to target species in urban landscapes. **Objective:** We used remote cameras to identify which vertebrate species removed Ontario Rabies Vaccine Baits (ONRAB) during October ORV projects in urban areas of Chattanooga and Cleveland, Tennessee, 2021-2022. **Materials and Methods:** Each year, we placed 32 cameras in urban areas of Chattanooga and Cleveland: four in each of eight, 1km2 cells with four cells each in Chattanooga and Cleveland. We placed one ONRAB bait at each camera and checked cameras daily for up to four days. **Results and Conclusion:** Bait removal across sites varied slightly by year with 32/32 (100%) and 24/32 (75%) of baits removed in 2021 and 2022, respectively. Pooling data across sites and years, 56/64 (88%) ONRAB baits were removed within four days. We identified the host species in 43/56 (79%) of bait removal events: 22/43 baits were removed (51%) by opossums (Didelphis virginianus), 10/43 (23%) by raccoons, 7/43 (16%) by eastern gray squirrels (Sciurus carolinensis), 2/43 (5%) by unspecified rodents, and one instance each (2%) by a grey fox (Urocyon cinereoargenteus) or coyote (Canis latrans). Results suggest in developed areas of southeastern Tennessee, opossums are the primary non-target competitor for ORV baits and remove ONRAB about twice as frequently compared to raccoons. It remains unclear whether opossum densities are greater compared to raccoons in these and other developed areas of the southeastern US. Uptake of rabies vaccine baits by opossums likely contributes to poor vaccine bait uptake by raccoons and lower rabies antibody seroprevalence post-ORV in developed areas of the southeastern US.

Key words: Bait uptake, Oral rabies vaccinatoin, Rabies, Raccoon, Non-target species

WR9P - Knowledge and attitudes related to the risk of exposure to rabies transmitted by wild canids in the state of Ceará, Northeastern Brazi

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Rabies in wild canids (bush dogs) represents an important cycle of the disease in northeastern Brazil. The frequency of wild canids and dogs and cats affected by the rabies variant of "Cerdocyon thous" is increasing. A cross-sectional study was carried out in communities in Ceará where outbreaks of rabies in wild canids have occurred, to describe the population's knowledge and attitudes towards the risks of exposure and rabies transmission. Seventy-two residents were interviewed in four communities in two municipalities and it was concluded that knowledge about the transmission and prevention of the disease, the perception of the risk of becoming ill and notions of the seriousness of the disease were limited. The proximity between man/dog/cat and wild animals may be favoring the maintenance of rabies in the region. Health education actions are needed in order to improve knowledge about the disease, emphasizing ways of preventing rabies transmitted by wild canids.

Key words: wild rabies, wild canids, bush dog, Cerdocyon thous

WR10p - Multidisciplinary approach with a One Health approach for the Prevention and Control of Human Rabies and in dogs and cats in the State of Nuevo León

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Introduction: The "One Health" approach is an integrated unifying approach that seeks to sustainably balance and optimize the health of people, animals and the ecosystem (WHO) and in Mexico, efforts have been made to strengthen this approach inter-institutionally in order to limit the occurrence of a case of human rabies by any animal species. In Nuevo León, as of 2007, the cases of wild rabies increased, with the insectivorous bat being the species that occurs most frequently and it was not until 2018 that there were cases of rabies in animals of economic interest, mainly bovines, transmitted by the blood-sucking bat (D. rotundus). **Goals:** Form a multidisciplinary and inter-institutional group with SADER, CEFOSAMP, Parks and Wildlife, in order to create joint interventions that allow us to identify routes, shelters, people and/or pets at risk. Material and methods: Each Institution made the immediate notification to the Ministry of Health, all the coordinates where animals with signs compatible with rabies were found were georeferenced, and jointly each area carries out the corresponding actions within the scope of its competence. For the georeferencing of the samples, cell phones were used, for the extraction of the brain samples, gloves, masks, surgical gowns, scalpel blades, and sterile containers were used. **Results:** From 2018 to date, the following rabies-positive specimens have been monitored: 20 insectivorous bats, 1 hematophagous vampire, 30 bovines, 2 donkeys and 1 equine, which has allowed us to jointly carry out the corresponding rabies focus actions as They are Post-exposure vaccination of contacts, guaranteeing vaccination coverage of at least 80% in dogs and cats, search for animals of economic interest with lesions and/or nervous signs, vaccination of herds that are in the range of the rabies focus, search for possible shelters , trapping and recommendations to the community on prevention measures in case of seeing wild species.

Key words: One Health, Rabies, inter-institutional group, Ministry of Health, Post-exposure vaccination.

WR12p - Evaluation of contingency actions to control the spread of raccoon rabies virus in Ohio and Virginia, USA

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Introduction: The raccoon (Procyon lotor) rabies virus variant (RRVV) is enzootic in the eastern United States and managed using oral rabies vaccination (ORV) to prevent and control spread. Breaches of ORV zones occasionally occur, resulting in costly contingency actions due to increased efforts involving enhanced rabies surveillance (ERS) including trap-euthanize-test (TET), ORV at higher bait densities and greater frequency, and trap-vaccinate-release (TVR) of target animals. **Objective:** We investigate two contingency actions in Ohio and one in Virginia using a dynamic, multi-method occupancy approach to examine relationships between specific management actions and RRVV occurrence, including whether ERS efforts were adequate to detect additional rabid animals around the index. Methods. Surveillance data were analyzed to estimate RRVV occurrence seasonally across 100 km2 grid cells during 2015-2021, to examine relationships across three spatial scales (contingency ORV area, regional ORV area, broader region including ORV and unmanaged areas). **Results and Conclusions:** The location of a grid relative to the ORV zone was the most influential factor explaining RRVV occurrence at the broader regional scale. Raccoon TVR was associated with declining RRVV occurrence across all three contingency areas yet the trend was most pronounced in Ohio where more TVR was reported. In Virginia, ORV strategies were as important as TVR in reducing RRVV occurrence. The TET actions targeting raccoons were critical for ERS, but the impacts on RRVV occurrence remain unclear because TET often is implemented early on when RRVV occurrence is stable or increasing. The probability of detecting additional RRVV cases was exceptionally high immediately following the index, declined after the initial pulse of TET effort, yet remained higher overall during contingency responses compared to pre-contingency ERS levels. Across the OH and VA contingencies, RRVV cases were contained within one year and the integrity of the ORV zone was restored within 2-3 years.

Key words: contingency action, dynamic occupancy, enhanced rabies surveillance, raccoon rabies virus, wildlife rabies control

WR14p - Cost Effectiveness Analysis of the Texas Wildlife Rabies Border Maintenance Zone

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Introduction: Wildlife oral rabies vaccine (ORV) programs in the US have helped to prevent the westward expansion of the raccoon rabies variant (R-RV) as well as support elimination of the Texas (TX) gray fox (TF) and the domestic dog RVs circulating in coyotes (DDC). Elimination of these two RVs cost $68 million USD ($3.8 million USD/yr.) at the state level; plus, indirect support supplied by the federal government. A previous economic analysis of the DDC RV elimination demonstrated a positive cost/benefit ($3.38 to $13.12). **Objective:** To estimate the on-going value of the Texas ORVP Border Maintenance Zone (BMZ) using a cost-effectiveness analysis (CEA). **Materials and Methods:** Public health data provided by the Texas Department of State Health Services, Austin, TX were divided into fixed costs CF (i.e., ORV doses, distribution costs) and variable costs (CV): rabies surveillance, post-exposure prophylaxis (PEP), and contingency actions. Three BMZ rabies scenarios were compared. **Results:** In Scenario 1, the current BMZ remains intact with no rabid animal incursions. In this scenario, wildlife rabies surveillance expenditures could increase 155% before exceeding the current BMZ rabies prevention value. Scenario 2 models one rabid animal incursion into a rural area of the BMZ, resulting in a single contingency action without human exposures. In this scenario, each contingency action adds 25% annual costs and the combined impact of three contingency actions exceeds the long-term BMZ benefit value. Scenario 3 is a single rabid animal incursion into a populated area of the BMZ resulting in PEP and increased domestic animal vaccinations. In scenario 3, one contingency action (Cv > 37.5%) has a significant impact on variable costs and exceeds today's BMZ's operational budget. Discussion: Today, there are emerging rabies risks threatening the TX BMZ. This study shows the importance of maintaining this program and its ongoing public health benefit.

Key words: Economics, Dog rabies, Benefits, Costs, Efficiency

WR15p - Estimation of the population of Cerdocyon thous and prevalence of the rabies virus in the municipalities of Zapayan and el Piñon in the department of Magdalena

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In 2013, the Magdalena zoonoses table raised the possibility of requesting a control hunting permit to lower the population density of Cerdocyon thous (gray fox), due to the detection of several cases of rabies in foxes, which had presented in an endemic area for the disease in this department.

Corpamag, who is the environmental entity in charge of issuing this type of permit, determined that it did not have the necessary elements to issue the permit, since there were no known population data or the possible prevalence of the virus in wild foxes in the area, nor did we have data on the possible methodology to be used to carry out a hunt of this type. A work was implemented to quickly obtain the data that would allow us to: Determine in the field the relative abundance of the populations of wild carnivores in localities of the Municipalities of Zapayán and El Piñón, the area affected by the outbreak. Establish if there was infection of the carnivore population in the two study locations of the Department of Magdalena. Institute a protocol for diagnosis and response to the emergency of the presence of rabies in wild carnivores. With the data obtained, respond to the control hunting request.

The four population sampling methodologies showed that Cerdocyon thous is the most frequent carnivore in the area with population densities of 2.2 to 2.4 animals per square kilometer. There was no evidence of the presence of the rabies virus in the captured carnivores (9) that were evaluated with a rapid diagnostic methodology and in the case of foxes (7), additional brain tissue was sent to the laboratory as a test control and counted. also with the laboratory standard for individuals 1, 3 and 6; who underwent the standard FAT test, which was also negative for all.

Key words: Cerdocyon thous, Colombia, Magdalena, prevalence

WR16p - Rabies in wild canids and the cerdocyon thous variant in Northeastern Brazil, spatial distribution and epidemiologic importance

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Rabies in wild canids represents an important cycle of the disease in northeastern Brazil. Since the 1980s, rabies in this species has been frequent, with episodes of rabies transmission from wild canids to dogs, cats and humans. The importance of the disease caused by this specific viral variant is highlighted by the diversity of hosts it has in the region and its great potential as a public health problem, as well as animal health. The aim of this study was to describe and characterize the occurrence of rabies in wild canids in the Northeast of Brazil between 2002 and 2021, using official records from the national health services database, notified to the Ministry of Health, as the data source. The characteristics of the temporal and spatial distribution of rabies cases in wild canids were described, followed by the cases registered in humans, dogs and cats that were detected with the same viral variant, adapted from wild canids and called "C. thous". In addition, care provided to people exposed to wild canids that could potentially transmit rabies was described, along with data on post-exposure anti-rabies prophylaxis (PEP) by the Unified Health System (SUS). TheWe analyzed the frequency distribution of the number of cases according to the month of occurrence, by constructing an endemic channel for the disease, and observed a slight seasonality, with a tendency for the number of cases to increase from May onwards, and decline from November onwards. Of the 1,017 tests carried out on wild canids in the Northeast over the study period, 608 cases were laboratory-confirmed for rabies, achieving a positivity rate of 59%. There was a predominance in some states, with quite pronounced variation between the different UFs. The highest proportion of recorded cases occurred in Ceará (31.7%), Bahia (23.5%) and Pernambuco (21.2%), in 254 different municipalities, almost half of which (49%) had recurrent cases. With regard to the spatial distribution of cases of dogs, cats and humans (n=68) with the C. thous variant, it was observed that 70.6% (48) of the reported cases occurred in municipalities other than those which reported cases of rabies in wild canids, revealing that surveillance of exposed animals and/or suspect animals may have been insufficient for the early detection of viral circulation in these areas. A total of 16,652 prophylactic cases of accidents involving wild canids were reported in different municipalities, many of which had no records of rabies in these animals. However, only 64.6% of these victims were properly prescribed serum and vaccine. The increase in records of wild canids, canine cases, domestic cats and recent human cases of the C. Thous variant, reiterate the importance of preventive health actions and PEP, highlighting great concern about the silent municipalities, with no recorded occurrences of wild canids and perhaps positive for rabies. This strongly suggests the need to improve epidemiological surveillance actions.

Key words: rabies in wild canids, Cerdocyon thous, rabies surveillance

WR17p - Rabies serologic survey in maned wolves, an endangered wild canid species in Brazil

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Although rabies transmitted by dogs in Brazil has been considered controlled in wild animals, the occurrence and transmission to humans and other domestic animals has gained importance each year. Many different rabies virus variants circulate in the Brazilian territory and a few are non-classified, the more important ones have as reservoirs the crab-eating fox (*Cerdocyon thous*) and the marmoset (*Callithrix jacchus*), both involved in human cases. It's important to notice that the variant related to *C. thous* is derived from variant 2, maintained by domestic dogs, spilled over to this wild carnivore, and adapted to it. The deforestation process leads to the retraction of the territory occupied by wild animals, threatening their survival directly or indirectly, through the increased occurrence of diseases, with the possibility that this newly affected specie becomes a reservoir, bringing the importance to monitoring the circulation of pathogens in wild animals, especially rabies virus, due to its epidemiological complexity. A serologic survey in a large Cerrado area named Fazenda Trijunção, localized in Bahia state (NE region) was the scenario for this study conducted on free-ranging maned wolves (*Chrysocyon brachyurus*), which is the most important wild canid in Brazil and is classified as an endangered species. A total of 10 adult animals, 5 males, and 5 females were sampled, between 2019-2022, and serum was evaluated by Fluorescent Antibody Virus Neutralization (FAVN) test to detect anti-rabies antibodies. Three animals had titers of 0,1UI/mL (30%), considering this title of neutralizing antibodies as a sign of previous contact with the rabies virus. Albeit none of the captured animals presented clinical signs during the sampling, our study demonstrates that the virus is circulating in the studied area, but the infection source remains unknown, being possible to consider contact with infected wild animals, as *C. thous* or through feeding.

Key words: wild carnivore, rabies antibodies, Chrysocyon brachyurus, endangered species, cerrado

WR18p - Rabies Risk Management in Churchill, Canada: A One Health Collaborative Approach

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Churchill is a town of significant ecological interest in northern Manitoba, Canada that sits along the western coast of Hudson Bay. In spring of 2022, it had a spike in rabies cases due to the arctic fox variant which resulted in multiple human and domestic animal exposures. Manitoba Rabies Central, a One Health collaborative group comprised of Public Health, Agriculture, and Wildlife, partnered with the town to establish a holistic health framework for action to improve rabies awareness and reduce exposure risk. The Churchill Rabies Management Working Group met in June of 2022 to evaluate the unique rabies risk in the region. Six key action points were outlined by the Working Group: A rabies awareness campaign; improving waste management within town & deterring wildlife-feeding practices near town; strengthening the regulations around sled dog vaccination and improving the efficiency of the domestic animal lay-vaccination program; school-based education programs on rabies, wildlife safety, and dog-bite prevention; determine the feasibility of wildlife vaccination; and continued collaboration between the One Health partners with yearly meetings of the Churchill Rabies Management Working Group. Phase one of the framework for action began in January 2023, with a rabies awareness campaign and school-based educational events focusing on dog-bite prevention and wildlife safety. The fox oral vaccination project began model parameterization in June 2023, and results will be used to inform vaccination strategies, if feasible. Additional animal-proof garbage receptacles were added to the town, and waste management improvements are planned over the next several years. Since June 2022 there have been no further wildlife exposures. A One Health collaborative approach will be crucial to sustaining ongoing risk management activities. Awareness and risk reduction activities will be continuing over the next 4 years in preparation for the next anticipated rabies outbreak, which is expected in spring 2026.

Key words: rabies, wildlife, One Health, arctic fox, risk management

WR19p - Identification of variables associated to rabies virus infection transmitted by wildlife to domestic cats in the state of Yucatan

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Introduction: The growing population in Yucatan has led to the expansion of construction in the Mayan jungle for tourist spaces, residential areas, and agriculture. This benefits the state's economy, but causes changes in the ecosystem, bringing wildlife into contact with domestic fauna. Recently, rabies cases in domestic cats (Felis catus) have increased **Objective:** This study aimed to identify variables that could be acting as triggers and favor spillovers between wild mammals and domestic cats. **Material and methods:** Between 2000 and 2022, the Rabies Laboratory (InDRE) recorded a total of 60 rabies cases in Yucatan: 9 in domestic cats, 2 in humans (the last one transmitted by a dog was in 1998), and the remaining cases involved wild species. Antigenic and molecular characterization was performed to determine the origin of the virus. The ArcGIS software was employed to generate maps depicting the geographic locations of rabies outbreaks in domestic cats. A logistic regression model was applied to investigate the association between cat rabies cases and environment type (rural/urban). **Results:** Three antigenic variants were detected: V1 (n=1); (V3) (n=1), and the canine-originated Yucatan sylvatic transmitted by skunks (n=7). Rabies cases occurred at the urban-jungle interface, favoring contact between domestic felines and wildlife. This interaction promotes the disease transmission in both directions. Urban areas showed statistically significant increased odds (OR= 60.7, 95% CI: 15.6-252.1, $p<0.001$) of cat rabies cases compared to rural areas. This raises the risk of rabies infections in domestic cats and potential reintroduction in dogs if vaccination rates decline, due to the genetic similarity between Yucatan sylvatic variant and the canine virus. **Conclusions:** Cats rabies has gained attention in the Americas. This study pioneers the One Health approach to rabies in Mexico. Multidisciplinary approaches will enable the establishment of improved strategies for preventing and controlling this disease in domestic cats.

Key words: Felis catus, urbanization, spillover

DIAGNOSTIC

D6p - Update: Further optimization of pan-lyssavirus LN34 assay for rabies Diagnosis

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Rabies is a fatal zoonotic disease, and control in animals and prevention in people both rely on the use of validated, reliable diagnostic tests. The pan-lyssavirus RT-qPCR LN34 assay has been increasingly adapted in rabies diagnostic laboratories globally as a confirmatory testing or a primary testing method. Here we present updated data on samples tested between 2017-2022 at CDC rabies laboratory on the ability of the LN34 assay to resolve DFA indeterminate samples, especially in the context of non-specific or atypical fluorescence, when both assays are run side-by-side during confirmatory testing. The LN34 assay has been able to detect rabies variants robustly. To address the significant sequence diversity across the Lyssavirus genus, we further optimized the primers to improve performance of the LN34 assay in several Lyssavirus species and host species with no loss in performance across diverse rabies virus clinical samples. Newly optimized primers showed improved performance for Aravan lyssavirus, European bat lyssavirus 1 and 2, Shimoni bat lyssavirus, Ikoma lyssavirus, Lagos bat lyssavirus B, and Mokola lyssavirus. As LN34 assay is highly sensitive and specific for rabies diagnosis, it is also important to prevent false negative results due to human errors in the LN34 assay set-up process, we have developed a protocol for a multiplexed LN34m assay that includes an internal host beta actin mRNA RT-PCR assay for the animal samples testing, which could further simplify the LN34 assay set-up, lower cost, and improve its performance.

Key words: Rabies, Pan-lyssavirus LN34 assay, Lyssaviruses, multiplex PCR, diagnosis

D7p - Proficiency tests (PT) for the detection of the rabies virus by Direct Immunofluorescence (DFA) in the Americas 2017-2022. CENASA-Mexico, OMSA Reference Laboratory for Rabies

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Introduction: Proficiency tests (PT) are a tool to support quality assurance, they allow evaluating the performance of rabies diagnostic laboratories. For this reason, national and international standards based on Quality Management Systems include participation in TP as a requirement as a method validation tool. The TP allow the standardization and harmonization of the diagnosis, identify the differences and problems and initiate the corresponding actions for their improvement, all this to guarantee the correct diagnostic surveillance of the rabies virus in the Americas. **Objective:** Analyze the results obtained from the laboratories of the American continent that participated in the TPs organized by CENASA, in order to evaluate their performance, identify possible problems, see the strengths and initiate the corresponding actions for the improvement and standardization of the Diagnosis of rabies by DFA at the continent level as a tool for the control and elimination of rabies in the countries. **Method:** A retrospective study was carried out from the years 2017 to 2022 in which CENASA develops TP in accordance with the NMX-17043-IMNC standard and this study includes the evaluation of 23 laboratories in order to know the strengths and areas of opportunity in the diagnosis by the DFA test. **Results:** The 23 participants had to detect the absence-presence of the rabies virus in the brain samples, 14 participating laboratories (60%) obtained 100% in all the evaluated criteria (concordance, sensitivity and specificity). The other laboratories obtained a percentage less than 100%. **Conclusions:** Several factors can affect the educated performance of laboratories in the diagnosis of rabies, among them is the correct quality control of the reagents, the use of reference controls, correct follow-up of the procedures, as well as the training of the personnel. These TPs have allowed the countries to standardize and ensure the quality of laboratory results of diagnostic tests.

Key words: Rabies, Proficiency Tests, Diagnosis, Immunofluorescence (DFA), America

D8p - Evaluation of the Bionote LFD for Rabies Diagnosis Using a Modified Protocol

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Although lateral flow devices (LFD) have been reported to detect cosmopolitan dog rabies virus antigens, commercial LFDs have not reliably detected the diverse rabies virus variants RVV found in the USA (40-60% sensitivity in 2018 OIE study) when used according to the manufacturer's recommendations. At CDC, modifications to the protocol increased sensitivity and specificity of one commercial product, Bionote Rabies Anigen Test Kit to detect the terrestrial RVV and bat variants seen in the USA and cosmopolitan dog variants with sensitivity of 98% and specificity of 100%. Collaborations for comparison testing of brain samples by DFA and the modified lateral flow assay (LFA) were initiated with 6 Public Laboratories (AZ, CA, IL, PA, ND and PR) as well as the AK Department of Fish and Game (DFG), and there are plans to expand study to increase testing of more endemic RVVs within the US and other countries to see if our findings could be reproduced. Modifications of the commercial protocol included: 1) Testing of the full cross-section of brain stem only, the tissue mostly likely to contain antigen. 2) The mincing of the entire cross-section piece brainstem by carefully slicing with a scalpel to paste and transferal to a tube to coat the swab with a representative sample 3) Limiting the amount of brain coating the swab by rubbing it against the side of the coating tube before transferal and blending into the kit buffer. In contrast, the manufacturer's instructions require preparation of a 10% combined brain suspension in PBS, prior to transferal of the swab into sample buffer an approximate 1:30 dilution of brain stem. To date 821 valid tests were completed in this study with sensitivity of 96.2% and specificity 99.8% as compared to DFA or real-time RT-PCR.

Key words: Rabies, Diagnosis, RDT, Lateral Flow Assay (LFA), Direct Fluorescent Antibody (DFA)

D10p - Diagnosis of Rabies Wild Origin. In National Veterinary Diagnostic Laboratory LNDV ICA. 2020-2022

Juan Carlos Ospina Chirivi[1], Fabiola Rodríguez Arévalo[1]

1 National Laboratory of Veterinary Diagnosis. Colombian Agriculture Institute.

Introduction: Under the framework of the National Program for the Prevention and Control of Rabies of Wild Origin (ROS), ICA attended to 100% of notifications for neurological symptoms in production animals (cattle, horses, swine, sheeps and goats) and performs surveillance of viral circulation in hematophagous bats as potential transmitters of the virus. LNDV processes the samples and makes the diagnosis by Direct Immunofluorescence (IFD), Indirect Immunufluorescence (IFI), Biological Test (PB) and histopathology. **Materials and methods:** From brain samples of the cortex, hippocampus, thalamus, cerebellum, and medulla, IFD was performed. The samples positive by IFD underwent viral typing by IFI using IFI with monoclonal antibodies. The Biological Test (BP) is performed on all negative samples by IFD with reports of exposure to humans and/or that come from horses or when the IFD result is inconclusive. **Results:** In 2020, 224 samples were analyzed by IFD, with 24 positive results (10%), 54 biological tests and 24 IFI were performed; in 2021, 354 samples were analyzed, with 55 positive results (15%), 82 biological tests and 59 IFIs were performed; by 2022, 314 samples were analyzed, with 35 positive results (3%), 104 biological tests and 36 IFIs.The antigenic variants that predominate in Colombia are V3 and V5 belonging to strains of hematophagous bats. **Conclusion:** The IFD is a rapid and timely diagnostic test that allows prevention measures to be taken in one day, such as vaccination of the affected species and early warning to public health agencies in cases of human exposure. Antigenic typing has made it possible to determine the causal transmitting agent of the foci detected where the hematophagous bat is the main transmitter; fundamental basis for the adoption of sanitary prevention and control measures.

Key words: Immunofluorescence, biological test.

BATS RABIES

BR7p - A bibliometric survey of the common vampire bat prey

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2 Virginia Tech

The common vampire bat (Desmodus rotundus) is distributed in the American continent in natural habitats from central Mexico to northern Argentina. D. rotundus is a bat that feeds exclusively on the blood of different species of vertebrate animals. This eating behavior generates impacts on animal and human health due to the risk of transmission of the rabies virus. The objective of this study was to identify wild and domestic animal prey of the common vampire bat (D. rotundus) in its geographic range through a systematic review and bibliometric analysis. The scientific literature in English, Spanish and Portuguese related to the diet of D. rotundus in the Americas was searched and selected from referential databases, using Excel and RStudio. The geographic location and the biome where the depredations were documented were recorded. D. rotundus was observed to be capable of inhabiting a wide variety of ecosystems, from deserts to tropical forests, even at elevations up to 3100 meters. More than 32 wild and domestic species were identified in their diet, which varies from small mammals and wild and domestic birds, such as the nine-banded armadillo (Dasypus novemcinctus) and domestic cat (Felis catus), and chickens (Gallus gallus domesticus) and Humboldt penguins (Spheniscus humboldti), respectively, to large predators, such as the puma (Puma concolor), which shows that D. rotundus is an example of high animal resilience, due to its ability to adapt its diet according to the prey available in its environment. . The bibliometric analysis highlighted the versatility of D. rotundus in terms of its feeding and distribution.

Key words: diet, food preference, Phyllostomidae, sanguivorous bat, Desmodus rotundus

BR8p- Active surveillance of rabies of wild origin in the Departments of Cauca and Vaupés: Focus on bats

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1 Instituto Colombiano Agropecuario

Introduction: Within the framework of the National Program for the Prevention and Control of Rabies of Wild Origin (ROS), an officially controlled disease in Colombia, identification, and control of hematophagous bat Desmodus rotundus has been carried out effectively, thus avoiding the economic impact on primary production due to rabies outbreaks in livestock farms and the considerable decrease in exposure to this deadly disease for humans too. Within the control activities of bats, captures in corrals and shelters are contemplated - active surveillance - where it has been evidenced in the department of Cauca that biology and behavior of some of the captured Desmodus rotundus is not reported in the literature, also other hematophagous species such as Diphylla ecaudata and Diaemus youngui have been identified in Cauca as well as in Vaupés, an important aspect to take into account in control actions. AIM. Present the field experience related to the control activity of the hematophagous bat Desmodus rotundus, in the department of Cauca and Vaupés Colombia. **Materials and methods:** For this control it is essential to establish the actions to follow against the capture of blood-sucking bats with mist nets in corrals in refuge. **Results:** Through population control, it is intended to reduce the impact on animal production and the risk in humans due to bites from blood-sucking bats infected with Rabies. **Conclusion:** Notifications received from vampire bat bites allow early control or minimize the impact of a rabies outbreak and monitor the location and registration of control activities in the national territory regarding relevant aspects such as behavior and climate change.

Key words: Diphylla ecaudata, Desmodus rotundus, Diaemus youngui.

DOG RABIES

DR12p - A mathematical framework to optimize placement of dog rabies vaccination campaigns: lessons for future pandemics

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Introduction: Mass vaccination is an essential public health strategy aimed at preventing the spread of pathogens. A successful example of mass vaccination are dog rabies vaccination campaigns, that rely on dog owners bringing their dogs to pre-specified vaccination sites. Similarly, during a pandemic millions of people must come to vaccination sites during a short period of time

to rapidly achieve herd immunity. Our research identified multiple barriers to achieving herd immunity during mass dog vaccination campaigns. Some of the most important barriers include distance to the vaccination site and long waiting lines. For COVID-19 vaccination, these same barriers were reported in multiple countries. **Objective:** To increase mass dog vaccination participation in silico by optimally placing fixed-point vaccination locations to minimize the distance that dog owners must travel and the length of the waiting lines. **Materials & Methods:** We used a Poisson model to calculate the probability of participation as a function of distance to the closest vaccination point. To fit the model, we used survey data spanning 2016 - 2019. To optimally place vaccination sites, we employed multiple computational recursive interchange techniques and compared predicted participation with these optimally placed vaccination sites to real-world locations employed during 2016. **Results:** Algorithms that integrated traveled distance with people leaving the waiting lines provided the best solutions for fixed-point vaccination placement. Optimal vaccination placement to reduce traveled distance is expected to increase participation by 7% overall and improve vaccine equity. Managing waiting lines through optimization could increase participation even more but parameterizing the lines was challenging. **Conclusion:** Using a data-driven computational algorithm to combat an ongoing urban rabies epidemic allows for optimally allocating limited resources to maximize vaccination coverage and increase vaccine equity. In addition, mass dog vaccination campaigns offer the opportunity to develop new models for mass vaccination for controlling other diseases.

Key words: Dogs, Herd immunity, Mass vaccination, Optimization, Rabies

DR13p - Canine rabies control in Brazil: past and present

Silene Manrique Rocha[1], Fernanda Bordalo[1], Francisco Edilson Ferreira De Lima Junior[1], Nathalie Estima[1]

1 Ministerio da Saúde Brasil

In Brazil, over the last 40 years, there has been a significant reduction in rabies cases in dogs, due to surveillance actions that have resulted in the interruption of the circulation of the AgV1 and AgV2 variants of the rabies virus, which are considered to have the greatest potential for spreading among dogs in urban areas. The aim was to describe the epidemiology of canine rabies through a series study of cases notified to the Ministry of Health between 1980 and 2022, including cases confirmed by laboratory and clinical-epidemiological criteria. The data was analyzed using Microsoft Excel 2016, and absolute and relative frequencies, averages and incidence rates were calculated. During the period, 28,805 cases were reported in domestic dogs. In the 1980s, 24,950 cases were reported, which represented 86.6% of the total number of cases reported nationwide, and approximately 90% of the cases were clinically and epidemiologically compatible with the AgV2 variant (domestic dog). Between 2000 and 2022, of the 3,914 (13.5%) records in the country, 921 (23.7%) were in the year 2000. In the same period, in addition to the significant reduction in records, 10.4% (n=371), the epizootics of rabid dogs with AgV1 and AgV2 were located in specific points such as municipalities on the border with Bolivia in Mato Grosso do Sul and Maranhão, respectively. From 2010 to 2022, of the 193 samples that underwent antigenic and genetic research, there was an emphasis on canine rabies genetic lineage of the rabies virus from wild mammals such as hematophagous bats (AgV3) and wild canids AgV2* (Cerdocyon thous). Among the wild variants, the highest frequency observed was AgV2*, with 20% (35/193), all originating in the Northeast region of the country. The study points to a control of the AgV1 and AgV2 strains, with their last record dating back to 2017. These results were possible due to the intensification of surveillance and control activities, such as blocking outbreaks (vaccinating dogs and cats) at the right time and massive anti-rabies vaccination campaigns. However, the rise of canine rabies caused by variants typical of wild canids (AgV2*) and hematophagous bats (AgV3) in urban centers shows a change in the epidemiological profile of rabies in the country and deserves greater attention from government and research institutions, with a view to introducing strategies to help organize control and mitigation actions in the face of rabies cases in animals, based on a single health approach, seeking to prevent human cases and blocking vaccination, if necessary, to prevent the spread of the virus among the different species.

Key words: canine rabies, health surveillance, rabies vaccination

DR14p - The use of the KoboToolbox platform as a capture mask for attacks by any species for a better analysis of the information, in the State of Chiapas, Mexico

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1 Instituto de Salud del Estado de Chiapas

Introduction: KoBoToolbox is a platform that helps us by collecting data through open sources software, allowing the analysis of health information to guide decision making in rabies control, being more precise compared to the current health systems. **General objective:** Improve the information system of attacks, to carry out a better analysis and identify risk areas to implement control actions of the human rabies. **Materials and methods:** The Human Anti-Rabies Prophylaxis file and card issued in the CENAPRECE Medical and Anti-Rabies Care Guide was uploaded, detailing the data of the aggression. In this first stage, the capture was carried out centrally in the health district, on a monthly basis through various users at the District, State and Federal levels, to validate the information simultaneously. **Results:** The platform itself issues automatic reports of the different variables captured that help us identify risk areas of attacks, types of aggressions and their characteristics until health discharge. Likewise, with the help of other systems or computer programs such as Geographic Information Systems (GIS), variables can be crossed obtaining visual products that help us make decisions. **Conclusion:** The use of the KoBoToolbox platform as an attack capture mask helps us in decision making and it facilitates the analysis of the captured information, identifying where and how attacks of any type of species are taking place, this is to guide rabies control actions based on evidence.

Key words: Rabies, Information,, Aggressions, Analysis, Decisions

DR16p - Evolution in municipal participation for the prevention and control of rabies in humans and in dogs and cats

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The results obtained are expressed successfully in our state, thanks to the support and necessary evolution of each of the actions that have been implemented in the Municipalities. Therefore, the constant participation of the Authorities of the state and municipal town halls is necessary, to continue granting the population the activities of the rabies prevention and control program to maintain the achievements obtained. **Objective:** Strengthen public health activities and identify municipal actions that must evolve to keep rabies prevention and control active. The development of new strategies such as: the operating models of municipal canine and feline care and well-being will help in the prevention and control of rabies and other important zoonoses in public health. At the same time, the objectives and activities of the human health and animal health institutions must be standardized with those of the municipalities, with the intention of maintaining the absence of cases of rabies in dogs and cats and therefore continuing to zero deaths in people. for this disease. **Conclusion:** It is necessary the constant participation of the authorities in the state town halls and the homologation of their strategies with the health institutions, to continue giving the population the activities of the rabies prevention and control program.

Key words: homologation, implementation, evolution, attention modules, absence of case

DR17p - Anti-rabies vaccination of dogs and cats as a blocking measure against a rabies outbreak in the indigenous village of Pradinho, Bertópolis - MG, Brazil

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1 Secretaria Municipal de Saúde

Introduction: Anti-rabies vaccination of domestic animals after an outbreak of human rabies is always an important measure for the prevention of this zoonosis in an indigenous population. It is common for dogs, cats, bats and indigenous children from Pradinho to live together indoors for recreational and cultural reasons, increasing the risk of accidental spoliation by bats. **Objective:** The objective of this action was to achieve an excellent standard of vaccination coverage of domestic animals, aiming at interrupting the epide-

miological chain of the disease between domesticated domestic animals and their owners. **Materials and Methods:** With the notification of the first case of human rabies, 5 mL of animal anti-rabies vaccine was promptly made available and administered to the entire susceptible canine and feline population of Pradinho village. Community animals older than 3 months were immunized by the local zoonosis team from a focal and perifocal radius delimited from 3 to 5 km from the outbreak site. As there were no cases of rabies in dogs and cats, revaccination with a 30-day booster after the first dose was not recommended. **Result:** 84 dogs and 14 cats (100%) from Pradinho received the vaccine dose. Vaccination took place at specific points in each village, although in some cases there was a need for vaccinators to contain the animals or actively search for animals in more distant places to immunize them. Due to the high percentage of dogs and cats living in practically all villages, there was a need for programmatic immunization to cover four other Maxakali indigenous communities located in the municipalities of Santa Helena de Minas, Ladainha and Teófilo Otoni. **Conclusion:** The vaccine blockade in the canine and feline population in Pradinho was effective for intervening in the rabies transmission chain, reducing the risk of transmission between animals and humans.

Key words: Dog rabies, Zoonosis, Control, Prevention, Spoliation by bats

PATHOLOGY AND INMUNOLOGY

PI6p - Analysis of the antigenic and immunogenic properties of the native rabies virus glycoprotein purified by Lens culinaris lectin affinity chromatography

Sandriana Ramos Silva[1], Cintia Pinto Da Silva[1], Iamamoto Nogi[1], Elaine Raniero Fernandes[1], Fernanda Guedes[1], Iana Suly Santos Katz[1], Karina Ribeiro Da Silva[1]

1 Instituto Pasteur

Due to the importance of the biological functions they perform, the rabies virus glycoprotein (RABV (G)) is a product of biotechnological interest, mainly because it is responsible for inducing the protective humoral immune response against viral infection. In previous studies, we have showed that Lens culinaris affinity chromatography (LAC) is efficient to purify the RABV (G). This work aims to evaluate the immunogenic and antigenic properties of RABV (G) purified by LAC method. The antigenic properties of purified RABV(G) were evaluated by direct ELISA using 90 samples of human serum from individuals who received rabies pre-exposure vaccination. As a negative control, sera samples from 20 non vaccinated individuals were used. For immunogenicity study, Swiss mice (n=8/group) were immunized with RABV (G)/10μg/dose with or without Poly I:C adjuvant or only PBS (negative control group). Following two immunizations, the RABV (G)-specific antibodies were measured by direct ELISA and RFFIT. As result, purified RABV (G) induced high titers of neutralizing antibodies (VNA >1000.0 IU/ml) in vivo detected by RFFIT; as well as RABV (G)-specific IgG1 (0.8 mean OD$\pm$SD) and IgG2a (0.3 mean OD$\pm$SD) antibodies, with a predominance of IgG1 ($p < 0.001$). It was also observed that VNA production was statistically higher in the group that received the RABV (G) associated with the adjuvant Poly:IC. No significant difference in the anti-rabies virus antibody titers was observed in negative control group. In addition, it was observed that RABV(G) was efficient in selectively detecting anti-RABV(G) IgG in the sera of vaccinated individuals when compared to negative control. Therefore, we concluded that the purification method used was efficient in preserving the native properties of RABV(G) essential in inducing an adequate humoral immune response. In this way, purified RABV(G) presented analytical potential for ELISA reagent and immunogenic assays for assessment of immune response to rabies vaccination.

Key words: Rabies virus glycoprotein, Lectin affinity chromatography, Humoral immune response, Rabies, Antigenicity

PI7p - Astrogial reaction in the cerebral cortex of rabies-infected mice

Gerardo Santamaria Romero[1], Andrea Del pilar Hurtado Cruz[1], Orlando Torres-Fernández[1]

1 Instituto Nacional de Salud

Introduction: Astroglia play an important role in nervous tissue homeostasis and neuronal function; however, scarce information has been published about rabies effect on astrocytes. Glial fibrillary acidic protein (GFAP), S100B and vimentin proteins are three of the most important astrocyte markers. **Objective:** To evaluate the immunoreactivity of GFAP, S100B and vimentin, as well as the cellular ultrastructure of astrocytes in the cerebral cortex of rabies-infected mice. **Materials and methods:** 28-day-old female ICR mice were inoculated intramuscularly (IM) or intracerebrally (IC) with CVS rabies virus. A third group of mice was double inoculated with the virus, first by the IM route and 48 h later by the IC route. Animals in the terminal phase of the disease were anesthetized and perfused intracardially with paraformaldehyde or glutaraldehyde. Brains were removed, coronal sections obtained on a vibratome, and processed for immunohistochemistry and electron microscopy (EM). **Results:** Infection caused differential effects on GFAP immunoreactivity depending on the route of virus inoculation. The expression of GFAP increased in the brains inoculated by the IC route and in those double inoculated (IM-IC). IM rabies virus inoculation hardly caused a slight immunoreaction to GFAP. In contrast, IM inoculation produced a significant increase in S100B immunostaining and in the number of cells immunoreactive to this calcium-binding protein. Furthermore, in the infected brains, the expression of vimentin, a neurodevelopmental marker, was reactivated. This effect was also notable in the hippocampus. On the other hand, EM did not reveal the presence of viral particles inside the astrocytes or any effect on their ultrastructure. **Conclusions:** Rabies virus is almost exclusively 'neuronotropic', however these results are evidence of a role for astrocytes in the pathogenesis of rabies. On the other hand, given the poor reaction of GFAP to rabies in natural infection, S100B is an alternative for the study of the astroglial reaction.

Key words: Rabies virus, Cerebral cortex, Astroglia, GFAP, S100B

PI8p - Dendritic pathology and map2 overexpression in the cerebellum of rabies-infected mice

María Paula Morales Arce[1], Andrís Obdulio Porras Rodríguez[1], Gerardo Santamaría Romero[1] Orlando Torres-Fernández[1]

1 Instituto Nacional de Salud

Introduction: Rabies virus (VR) is strictly neurotropic, but few cytomorphological changes are observed in nervous tissue when studied by conventional histopathological techniques; these are not proportional to the clinical severity of the disease. However, using the Golgi technique we have found notable morphological alterations in the dendritic pattern of cortical pyramidal neurons and in motor neurons of the spinal cord of mice inoculated with VR, associated with overexpression of MAP2, a cytoskeletal protein essential to give stability to the dendritic tree. **Objective:** To study the effect of VR infection on the dendritic morphology of Purkinje cells and on the MAP2 immunoreactivity of the cortex and deep cerebellar nuclei of mice. **Materials and methods:** Female ICR mice of 28 days old were inoculated with VR-CVS, in the hamstring muscles and, six days later, in terminal phase of the disease, they were subjected to deep anesthetic treatment and perfusion with paraformaldehyde or saline solution. The cerebellums were removed and processed by immunohistochemistry or the Golgi-Cox technique. Sagittal plane images obtained from slices made with a vibratome were analyzed. Some sections were processed for electron microscopy. Controls (Mock) were processed under similar conditions. **Results:** VR infection altered the dendritic pattern of Purkinje cells and caused increased MAP2 immunoreactivity in the molecular and granular layers of the cerebellar cortex, as well as in the deep nuclei. In Purkinje cells, MAP2 overexpression was so marked that the protein was revealed in the cell bodies of infected mice, but not in controls. In the thin sections, some areas with histological damage were also observed. **Conclusions:** The results obtained coincide with similar findings previously reported in the cerebral cortex and spinal cord. Therefore, dendritic pathology associated with MAP2 overexpression is a characteristic feature of rabies in the mouse model.

Key words: Rabies virus, Cerebellum, Golgi stain, Microtubule associated proteins, immunohistochemistry

Scientific Agenda RITA 2023 Colombia
Monday, October 16th

Hour	Topic	Moderators
	Opening ceremony	
2:00 - 2:30 pm	Hno. Nikky Murcia (Rector de la Universidad de La Salle Dr. Verónica Gutierrez (Presidente Comité Directivo Internacional) Dr. Juan David Corrales Dr. Leonardo Roa (Universidad de La Salle)	Dr. Juan David Corrales
2:30 - 2:50 pm	**Inaugural conferences** "The Global Strategic Plan to end human deaths from dog-mediated rabies by 2030" (Rachel Tidman/World Organisation of Animal Health)	Dra. Natalia Cediel
2:50 - 3:10 pm	"America's Governance in Rabies Elimination: recommendations form REDIPRA 17" (Dr. Marco Vigilato/(PANAFTOSA/VPH-PAHO/WHO).	
3:15-4:00 pm	**"Colombian experience on rabies control and prevention"** Dr. Jairo Hernandez (Ministerio de Salud) Dr. Franklyn Prieto Alvarado / Diana Walteros (Instituto Nacional de Salud) Dr. Edilberto Brito (Instituto Colombiano Agropecuario)	Dr. Nathalia Mendez and Dra. Paula Bermudez
4:00-4:30 pm	1. A validated sandwich ELISA immunoassay for the quantitation of rabies glycoprotein as a tool for vaccine formulation and its correlation with NIH potency test (Almario/VECOL) 2. History of rabies in Colombia: the time for an intentional One health approach is now (Dr Cediel/U. Salle)	
4:45-6:00 pm	Welcome Cocktail	

Tuesday, October 17th

	1. Human rabies & Prophylaxis	
8:00 - 8:45 am	1."Clinical impact of rabies: importance of evidence based guidelines" (Dr. Alfonso Rodriguez/ ACIN, Colombia) 2."Clinical approach to rabies under the One Health lens". (Dr. Wilmer Villamil/Centro de Investigación Ciencia de la Vida Universidad Simón Bolívar Barranquilla, Colombia)	Moderators: Dr. Alan Jackson (Universidad de Calgary, Canada) and Dr. Juliana Gonzalez Obando (UdeA, Colombia)
8:45- 10:15 am	1. Human rabies risks following exposure: Development of a rabies homunculus using an Artificial Intelligence tool (Dr. Stephen Scholand/Rabies free world) 2. Comparison of International Rabies Antibody Reference Standards (Dr. Susan Moore/U. of Missouri) 3. Cultural practices related to aggressions by potentially rabies-transmitting animals in Colombia. 2007 - 2009 (Dr. Luis Polo/U. Nacional de Colombia) 4. Development of SYN023 Anti-Rabies mAb Cocktail (Dr. Eric Tsao/Synermore Biologics) 5. Rabies and Dog Bite Prevention Training in Southwestern Kenya: Collaborating with Local Communities (Dr. Jerlyn Sponseller/Boehringer-Ingelheim) 6. Training in the appropriate approach in the first level of care of the patient exposed to the rabies virus by an animal susceptible to suffering from this zoonoses aimed at doctors and nurses in social service (Dr. Alma Aguilera/Servicios de salud pública de la ciudad de México)	
10:15 - 10:45 am	**Coffee break & Posters exhibition**	
	2. Epidemiology & Surveillance	
10:45 - 11:00 am	"Rabies epidemiology in Latin America and the Caribe" Dr. Marco Vigilato (PAHO)	Moderators: Natalia Cediel (Universidad de La Salle) and Dr. April Davis (NY state, USA)
11:00 - 12:15 p m	1. The widespread *Tadarida brasiliensis* population influences the distribution of rabies virus in Chile: preliminary results. (Dr. Zulma Rojas/U. Andres Bello) 2. An integrated spatial epidemiological approach to livestock rabies elimination in Brazil: the co-distribution of equine and bovine rabies in 2010-2019 (Dra. Holly Crompton/U. Queensland) 3. Model for Surveillance, Prevention and Control of Bat-Transmitted Rabies in Urban Areas of Valle Del Cauca, Colombia (Dra. Constanza Nuñez/ U Valle, Colombia) 4. Fifty years of the National Rabies Control Program in Brazil under the One Health Perspective (Dr. Silene Rocha/Min. Health, Brazil) 5. Cost Effectiveness Analysis of the Texas Wildlife Rabies Border Maintenance Zone (Dra. Stephanie Shwiff/USDA)	
12:15 -1:00 pm	**Round table: ¿Which are the regional challenges to achieve the canine rabies free status?** 1. Dra. Natalia Casas (Ministry of health, Argentina) 2. Dra. Veronica Gutierrez (Ministry of health, México) 3. Dr. Silene Manrique Rocha (Ministry of health, Brazil)	Moderators: Dr. Charles Rupprecht (Auburn University, USA) and Natalia Cediel (U. Salle -

		Colombia)
1:00 – 2:30 pm	**Lunch with International RITA Committee**	
2:30-2:45 pm	**3. Vaccines & Antivirals** Dr. Thomas Müller, "Oral rabies vaccination of dogs – new recommendations for field application and integration into dog rabies control programmes".	Moderator: Thomas Muller (Friedrich-Loeffler-Institute) and Dr. Alfonso Rodriguez (ACIN)
2:45 – 3:45 pm	1."Feasibility of ORV of dogs in Mexico; field studies on bait acceptance and immunogenicity" (Dr. Veronica Gutierrez, Min. Health-Mexico) 2. "Large scale ORV campaigns targeted at free-roaming dogs in Namibia" (Dr. Conrad Freuling/Friedrich-Loeffler-Institute) 3."The pathway to regulatory approval of an oral rabies vaccine" (Dr. Adrian Vos/CEVA) 4. "The interface of arctic foxes and free-roaming dogs in the Northern Communities in Alaska and Canada" (Dr. Karsten Hueffer,U. Alaska Fairbanks)	
3:45 - 4:15 pm	**George Baer Award session** Presentation of the Conference Pradinho rabies outbreak, Brazil: Response actions and their intervening factors Dilceu Silveira Tolentino Júnior (Winner of George Baer Award)	Dr. Verónica Gutierrez and Dr. Charles Rupprecht
4:15 - 5:15 pm	**Coffee break & Posters exhibition**	Dra. Natalia Cediel
5:30 pm - 7:30 pm	Meeting with Colombian authorities in charge of rabies program and international specialists about wild carnivores in Colombia.	

´Wednesday, October 18th

8:00-8:30 am	**Ivanete Kotait Award session** Early transcriptional modulation of SLC genes during rabies pathogenesis: possible crosstalk with glutamatergic pathways and neuronal protection in the brain. (Bastos et al) Winner of the IK award	Dr. Jane Megid and Dr. Charles Rupprecht
8:30 - 8:45 am	**4 Wildlife rabies control** Dr. Richard Chipman / Dra. Amy Gilbert (USDA, USA) "What are wildlife and people telling us? Considerations and conundrums in wildlife rabies management"	Moderator: Dr. Carlos Palacios (Fundación Pablo Cassará, Argentina) and Dr. Victoria Pereira (Universidad de La Salle)
8:45- 10:15 am	1. Exploring Rabies Transmission Dynamics at the Urban-Rural Interface: Engaging Student Citizen Scientists through Remote Camera Technology (Dr. Bender/Diné College) 2. Rabies virus serosurvey of the small Indian mongoose (Urva auropunctata) across multiple habitats in Puerto Rico, 2014-2021 (Dra. Are Berentsen/USDA) 3. Investigation into arctic fox oral rabies vaccination to reduce the rabies risk in Churchill, Canada (Jerao/Manitoba Agriculture) 4. Immunogenicity of recombinant live rabies virus vaccines in raccoons (Dra. Amy Gilbert/USDA) 5. Rabies virus surveillance in wildlife: a pilot of inter-institutional cooperation within the One-Health Framework (Dra. Maria Carreño/INS-Colombia) 6. Rabies in wild canids and the *Cerdocyon thous* variant in northeastern Brazil, spatial distribution and epidemiologic importance (Dr. Silene Manrique Rocha/Ministry of health, Brazil)	
10:15- 10:45 pm	**Coffee break & Posters exhibition**	
	5. Diagnostic	
11:00 -11:15 am	"Improving diagnosis in wildlife " (Dra. Lorraine McElhinney WHO CC/UK).	Moderator: Dr. Juan Montaño (RITA Int. Committee México) and Dr. Dra. Nathalia María del Pilar Correa Valencia (UdeA, Colombia)
11:15-12:30 m	1. Diagnostic evaluation of the first canine-variant rabies cases in Canada in over 60 years (Dra Christine Fehlner/ Canadian Food Inspection Agency) 2. Direct rapid immunohistochemistry test in rabies virus isolates of domestic canids from the Maranhao and Mato Grosso do Sul states, Brazil. (Dra. FernandaGuedes/Instituto Pasteur) 3. Automated detection of neutralising antibodies utilising a fluorescent rabies virus. (Dr. Joan Manuel Amaya/APHA) 4. Implementation of wooden applicators as an alternative in the dissection of the brain for the diagnosis of Rabies virus (Dr. Efren Jaramillo/Lab. Estatal de SP Nuevo León)	
12:30 - 1:45 pm	**Lunch with International RITA Inc / Local Committee/ Sponsors / RITA 2024 representative**	
	6. Bat rabies control	
1:45-2:00 pm	Dr. Diana Patricia Dallos (ICA) "Control of "Hematophagous bat" in the framework of the program for the prevention and control of wild rabies in Colombia"	Moderator: Dr. Diego Soler-Tovar (Universidad
2:00- 3:15pm	1. Situation of livestock rabies and the use of contact network to support hematophagous bat and rabies surveillance.	

	(Dr. Felipe Rocha/OPS) 2. Use of anticoagulants to control paralytic rabies and common vampire bat (Desmodus rotundus) populations: Historical analysis and perspectives (Laura Avila/U. Salle) 3. Molecular epidemiology and phylogeography of hematophagous bat Variant associated with human risk in Colombia (Dra. Maria Carreño/INS) 4. Epidemiological profile of the rabies virus transmitted by bats in the city of Fortaleza, Ceará (Dr. Moreira/Centro Universitario Christus-Brazil) 5. Bat status in Coahuila Mexico (Dr. Susan Moreno/Lab. Esta. Coahuila)	de la Salle, Colombia) and Janine Seetahal (USA)
3:15 – 4:00 pm	**Coffee break & Posters exhibition**	
4:00-5:15pm	**7. Dogs rabies & Control** Dr. Marco Vigilato (PAHO) "Advances to achieve Zero in 2030 in the Americas"	
	1. Alert level before rabies and population status of dogs and cats in the state of Puebla (Dr. Juan Balderas/Servicio de Salud de Puebla) 2. The potential of unmanned aerial vehicles ("drones") for dog-mediated disease surveillance (Dr. Ricardo Castillo/U. Pennsylvania) 3. Building local excellence to create sustainable and scalable rabies elimination programs (Dr. FredericLohr/Mission rabies) 4. Community Participation in the Promotion and Prevention of Rabies in Peri-urban Areas of the Municipality of Ibagué. (Merino/Universidad Cooperativa de Colombia)	Moderators: Dr. Luis Joaquin Polo (Universidad Nacional de Colombia) and Dr. Christine Fehlner (Canadá)
6:00 - 12:00	**Gala dinner & live music show & Benefit auction**	

Thursday, October 19th

	7. Dog rabies & Control (continuation)	
9:30.- 10:45 am	1. Development of a Province-Wide Lay Vaccinator Program: Rabies Risk Management in Manitoba, Canada (Dra. Alexandra Jerao/Manitoba Agriculture) 2. Rabies virus exposure in dogs from Brazilian indigenous communities by serological analysis (Dra. Camila Appolinario/UNESP) 3. The dynamic impacts of mass dog vaccination on rabies incidence (Dra. Elaine Fergusson/U. Glasgow) 4. Case-report for rabies control and novel strategies for rabies prevention in a rural community in the state of Sonora, Mexico (Dr. Jorge Abril/Secretaría de salud de Sonora) 5. Facing off against rabies: Testing novel facial recognition technology to identify dogs during vaccination campaigns (Dr. Anna Czupryna/Universidad de Glasgow)	**Moderator:** Dr. Luis Carlos Villamil (U. Salle Colombia) and Dr. Verónica Gutierrez (RITA, México)
10:45-11:15 am	**Coffee break & Posters exhibition**	
	8. Pathogeny & Immunology	Moderator: Dr. Jane Megid (Universidade Estadual Paulista (UNESP), Brazil) and Dr. Wilmer Villamil (ACIN, Centro de Investigación Ciencia de la Vida Universidad Simón Bolívar Barranquilla, Colombia)
11:15-11.45 am	1. Experimental Pathology with rabies neuroscience approach (Dr. Orlando Torres/INS) 2. The Milwaukee protocol for treatment of rabies (Dr. Rodney Willoughby/U. Wisconsin)	
11:45-12:30 pm	3. Immune response against different variants of the rabies virus directs the course and clinical manifestations of the disease (Dra. Elaine Raniero/Instituto Pasteur - Brazil) 4. Loss of calbindin expression in mice inoculated with rabies virus (Dr. Julian Naizaque/ INS-Colombia) 6. Immunopathological changes in renal and urinary bladder tissues during experimental infection with a rabies virus antigenic variant 3 (Dra. Livia Madeiros/ Instituto Evandro Chagas)	
12:30: 2:00	**Lunch Local Committee and RITA INC**	
2:00 -5 pm	Gold museum visit	
5:00 - 5:30 pm	**RITA 2024 presentation** **Poster award winner announce**	
5:20 - 5:45 pm	**RITA Colombia closure**	
5:45 - 7:00 pm	**Closure Cocktail**	

Friday, October 20th

9:00- 12:00 m	**RABIES IN THE AMERICAS CONFERENCE GLOBAL WEBINAR** **"RABIES IN CATS – AN EMERGING PUBLIC HEALTH ISSUE IN THE AMERICAS?"** Register in the following link: https://us06web.zoom.us/j/87142241597 Introduction Dr. Ce Rupprecht, Auburn University, Introduction Rabies In Cats In Colombia Dr. Luis Carlos Gomez, National Health Institute - Colombia Rabies In Cats In Brazil Dr. Silene Rocha, Ministry Of Health - Brazil Should we worry about rabies in cats? – A northern Americas perspective", Dr. Christine Fehlner - Canadian Food Inspection Agency Rabies In Cats From A European Perspective Dr. Paola De Benedictis, Istituto Zooprofilattico Sperimentale delle Venezie Rabies In Cats In Asia Dr. Gyanendra Gongal, World Health Emergency, WHO Regional Office for South-East Asia, New Delhi, India Rabies In Cats In Africa Dr. Philip Mshelbwala, University of Queensland, Australia Biologics For Cat Vaccination Dr. Joanne Maki, Boehringer Ingelheim Round table Discussion Noon End	Dr. Charles Rupprecht and local committee

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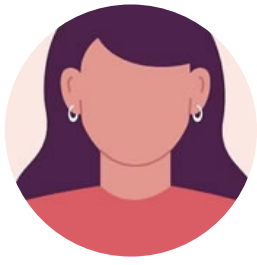

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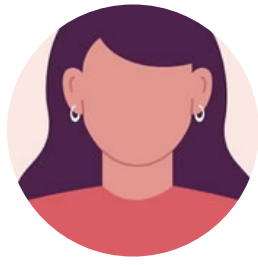

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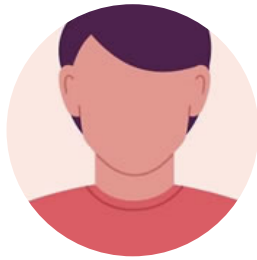

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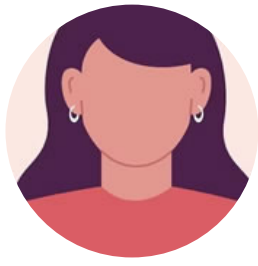

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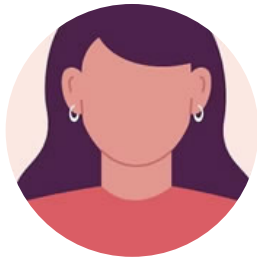

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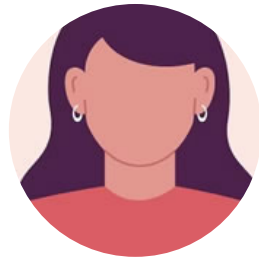

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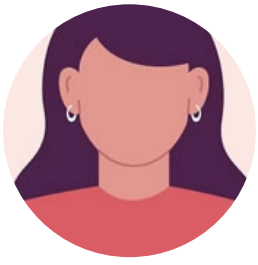

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