Rabies Surveillance Practices in Kansas

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About Me

- Hometown: Houston, Texas
- Undergrad at Kansas State University
  - Bachelor of Science: Animal Sciences & Industry
  - Minor: Food Science
- Internships at Merck Animal Health, USDA – ARS, and Hill's Pet Nutrition
- Current Position: Graduate Teaching/Research Assistant
- Always wanted to work in the Animal Health Industry since I was a kid
  - Originally wanted to be a veterinarian, but my career path has since changed!
- This Fall, I will be attending Texas Tech University in their One Health Sciences PhD program

Outline

- Applied Practice Experience (APE) site
- Background Information & Project Study
- Methodology
- Results
- Limitations
- Competencies
  - MPH Foundational and Emphasis Area Competencies
  - APE Products
- Key Findings & Public Health Implications
- Acknowledgements

APE Site

- Kansas Department of Health and Environment (KDHE)
  - Mission: “protect and improve the health and environment of all Kansans.”
  - Location: Topeka, KS
- APE dates: June 2025 – April 2026
- Infectious Disease Epidemiology and Response
  - Dr. Erin Petro, DVM, MPH, DACVPM

Rabies Overview

- One Health Issue
  - Rabies links human, animal, and environmental health
  - Transmission involves wildlife reservoirs, domestic animals, and humans
- Human Global Impact
  - 60,000 human deaths annually
  - 15 million receive post-exposure prophylaxis (PEP)
- Geographic Risk
  - Asia and Africa > 95% of deaths due to endemic canine rabies, limited PEP access, and inconsistent dog vaccination
- U.S. Context
  - Rare human cases, mostly from wildlife spillover
  - Near 100% fatality once symptoms appear

Rabies Prevention & Control

- Transmission & Disease
  - Virus spreads from infected saliva or neural tissue via bite wounds (bites carry 5-80% risk)
  - Travels through the Central Nervous System
- Diagnostics
  - DFA = gold standard
  - RT-PCR and dRIT used for confirmation
  - Kansas State Veterinary Diagnostic Laboratory (Rabies Lab) tests around 1,800 – 2,500 animals/year
- Prevention & PEP
  - PEP is nearly 100% effective if given promptly
  - Treatment costs range from $3,000 to $8,000
- Animal Vaccination
  - Licensed for dogs, cats, cattle, horses, and ferrets
  - U.S.: 39 states mandate rabies vaccination, but Kansas is not one of them

Project Study

- **Goal:** Evaluate the outcomes of animal contacts exposed to rabies in Kansas and validate rabies post-exposure prophylaxis (PEP) as an alternative to euthanasia for unvaccinated animals.
- Focus on the outcomes of animals after exposure
- Survey component implemented
  - Statewide survey conducted to identify county-level rabies vaccination laws and bite reporting management
- Significance
  - Updated the previous study and informed rabies control measures
- In partnership with KDHE

Data Sources

Rabies Surveillance Data

- Rabies surveillance data were obtained from EpiTrax for all reported rabies-positive animals
  - KSVDL animals
  - SCWDS tested animals
  - Any other reported results from other labs
- Study period: January 1, 2018 – December 31, 2024
- The dataset pulled from EpiTrax included both rabid animals and their associated contacts (exposed animals)
- Variables Analyzed: animal species, vaccination status, exposure category, & outcome

Study Population Overview

Two populations were included in this analysis

- Rabid Animals
  - Animals that had a rabies test performed
  - Has documented animal contacts
  - Source of exposure
- Exposed Animals (Animal Contacts)
  - Domestic animals exposed to rabid animals
  - Included dogs, cats, livestock, and other domestic species (horses and ferrets)
  - Used for outcome analysis

Key Points

- Rabid animals define the exposure event
- Exposed animals define the analytic population

Exposure Categories

- Direct exposure
- Probable exposure
- Low probability exposure
- No exposure

Data Cleaning & Classification

- Removed incomplete or duplicate records
- Focused on animal-to-animal exposures
- Human contact forms excluded
- Cases classified as confirmed (lab positive) or probable (not confirmed)

Methods – Analysis & Survey

- Analytic Approach
  - Descriptive analysis
  - Outcomes assessed: euthanasia, PEP w/ survival, PEP w/ death, no PEP w/ death
  - Collaboration with Stephanie Lindemann, the KDHE epidemiologist for statistical modeling (SAS)
- Inclusion/Exclusion Criteria
  - Depends on whether the animal was rabid or an exposed contact
  - Only animals with documented exposure to a rabid animal were included
  - Indirect exposures, missing outcomes, or animals unavailable for follow-up were excluded
- Statewide Survey
  - 100 local health departments sent a Qualtrics survey
  - Assessed county vaccination laws & bite reporting practices
  - Mixed question formats

Results – Animal Exposure Outcomes

- A total of 197 confirmed rabid animal contacts were identified during the study period
- Observation was the most common outcome, followed by euthanasia
  - Euthanasia is more commonly used among unvaccinated animals
- Majority of the cases had complete follow-up and documented outcomes

Contact Animal Disposition	Frequency
Euthanized	53
O/Q not indicated	11
Observation	97
Quarantined	29
Unknown	7
Total	197

Results – Rate of Euthanasia by Vaccination

- The euthanasia rate was substantially higher among unvaccinated animals
- Animals that were up to date on rabies vaccination had a very low euthanasia rate following exposure
- This demonstrates a strong association between vaccination status and exposure outcome

Euthanasia Rate of Animals Up-to Date on Vaccinations	Euthanasia Rate of Animals that are Unvaccinated
4.88%	65.67%

Results – Vaccination Status of Euthanized

- The majority of euthanized animals were unvaccinated
- Vaccinated animals accounted for a small proportion of euthanasia outcomes
- These findings further support the protective role of rabies vaccination

Vaccination Status	Frequency
Not vaccinated	44
Previously vaccinated for rabies, but not up-to-date	5
Unknown	3
Up-to-date on rabies vaccination	1
Total	53

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Results – Association b/t Vaccination Status & Euthanasia

Statistics for the Table of Vaccination Status by Euthanasia			
Statistic	**DF**	**Value**	**Probability**
Chi-Square	1	81.1102	<.0001
Likelihood Ratio Chi-Square	1	83.8164	<.0001

Odds Ratio and Relative Risks			
Statistic	**Value**	**95% Confidence Limits**	
Odds Ratio	37.3333	14.1849	98.2578
Relative Risk (Column 1)	13.1111	5.9030	29.1208
Relative Risk (Column 2)	0.3512	0.2490	0.4952

Interpretation = unvaccinated animals had **approximately 37 times higher odds** of euthanasia following exposure

Results – Logistic Regression Model

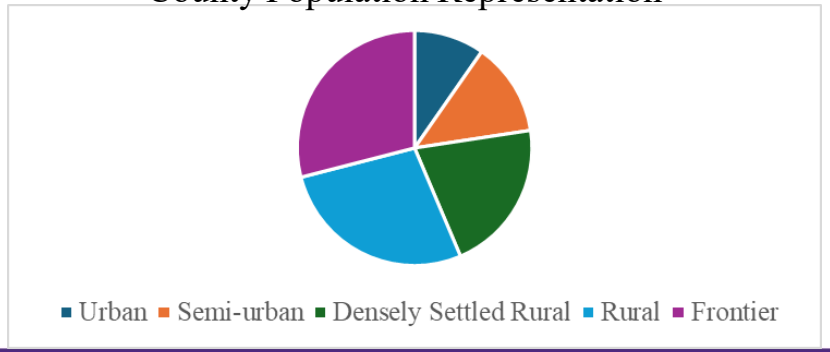
Analysis of Maximum Likelihood Estimates						
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	1.3218	0.2297	33.1018	<.0001
species2	**Cat**	1	-1.3843	0.3396	16.6138	<.0001
species2	**Cow**	1	-15.7132	770.0	0.0004	0.9837
species2	**Horse**	1	-2.4204	0.8482	8.1426	0.0043
species2	**Pig**	1	-15.7132	1333.7	0.0001	0.9906

- Species was significantly associated with the outcome and vaccination status
- Cats had significantly lower odds of surviving exposure management compared with dogs
- Livestock estimates were unstable due to the smaller sample sizes
- Vaccination status remained the strongest protective factor in exposure management decisions

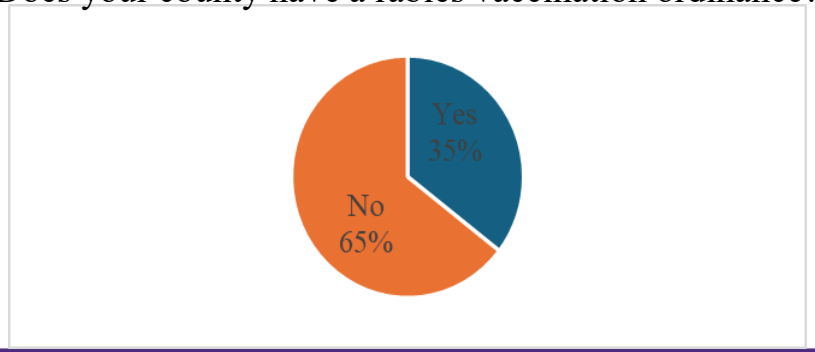
Survey Response Summary

- 110 contacts (100 LHDs) → 77 responses
  - 51 fully completed surveys were then analyzed
- 63 distinct counties represented across all population types
- Rabies vaccination ordinances
  - 22 out of 62 counties have county-level ordinances
  - 63% report city ordinances
  - 19 out of 50 counties require animal registration; 26 require vaccination for licensing

County Population Representation



"Does your county have a rabies vaccination ordinance?"



Bite Reporting & Local Needs

- Animal bite reporting: 82% of counties legally require bite reporting
- Statewide law support: 65% support a statewide rabies vaccination law
- Identified needs
  - More funding, staffing, and educational resources
  - Expanded community vaccination clinics and outreach
  - Stronger policies in unincorporated areas
  - Increased access to mobile veterinary and vaccination services

Limitations

Surveillance Data

- Submission-based reporting may underestimate exposures and vaccination coverage
- Small sample sizes for less common species limited the analysis

Survey Data

- Self-reported rabies ordinances may contain errors or incomplete knowledge
- 59% response rate → potential non-response bias

Analysis Gaps

- County-level demographic and socioeconomic factors were not included
- Geospatial, animal population, and wildlife reservoir data could improve the understanding of rabies risk

MPH & Emphasis Area Competencies

Competency	Description of Synthesis and Integration
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming, and software, as appropriate.	I interpreted a seven-year dataset of 376 cases from EpiTrax using SAS programming to manage and analyze the surveillance data. I also evaluated local rabies ordinances by designing and distributing a Qualtrics survey to 100 local health departments. I integrated these quantitative and qualitative sources to construct a more complete understanding of rabies trends and reporting practices across Kansas.
4. Analyze disease risk factors and select appropriate surveillance.	I evaluated surveillance trends through a descriptive analysis in collaboration performed in collaboration with a State Public Health Veterinarian and Epidemiologist. I validated these findings to identify current monitoring gaps and determined how improvements, such as a statewide mandate, could strengthen the accuracy of future disease reporting.
19. Communicate audience-appropriate public health content, both in writing and through oral presentation, to a non-academic, non-peer audience with attention to factors such as literacy and health literacy.	I translated rabies surveillance findings for different audiences by delivering an oral presentation to public health professionals and developing a research poster for a broader audience. I reconstructed how the information was organized and explained to ensure clarity and accessibility, while accurately conveying key findings.

Products & Competencies

Practice-Based Products that Demonstrate Competency Attainment	
Specific products	**Competency**
PowerPoint presentation geared towards public health professionals within the KDHE epidemiology group to present data analysis results	Competencies 3 & 4
A map of rabies vaccination laws/requirements by county in Kansas, through a survey sent to local health departments	Competencies 3, 4, 19, & 22
Poster presentation geared towards the public to educate on rabies control management and vaccination practices in Kansas.	Competencies 4, 18, & 19

Key Findings

Exposed Animals

Dogs: the largest group; higher vaccination coverage and survival

Cats: lower vaccination status; higher odds of euthanasia

Vaccination Status

Strongest predictor of outcome

Unvaccinated animals are 37 times more likely to be euthanized

Survey Insights & Public Health Implications

Survey Findings

64.5% of counties lacked rabies vaccination ordinances

65% of LHDs support statewide vaccination laws

Variation in bite reporting and ordinance knowledge highlights structural gaps

Public Health Implications

Routine vaccination critical for survival and public health

Statewide policies could standardize vaccination and surveillance

Strengthening LHD education, communication, and coordination enhances rabies control

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THANK
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