Optimizing the Distribution of Rabies Tags for Orleans Parish

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Repository: github.com/RebeccaLewis-DS/dsc680-project2.git
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Which Domain?

Rabies is a virus that affects mammals and is most often transmitted through the infected animal's bite. [10] Cases are reported to the CDC each year primarily in wild animals like bats, raccoons, skunks, and foxes; however, any mammal can be infected including domestic dogs, cats, and humans. [10] Only 1-3 cases of rabies in humans are reported annually in the United States; however, about 55,000 get treated to prevent rabies infections after being bitten or scratched by an animal. [2] Many areas in the United States have laws that require domestic animals to be vaccinated against rabies, which has led to the drastic reduction in occurrence in domestic dogs and cats. Only 60-70 dogs and 250 cats are infected each year, mostly due to unvaccinated animals being bitten by wildlife. [4] Internationally, the statistics are not as positive with 35-65 thousand people dying each year from the rabies virus, primarily in Africa and Asia. [5]

A challenge facing the elimination of rabies is the effective organization and adaptation of vaccination programs across regional levels. [5] Even though rabies vaccinations are mandatory for dogs across the United States, only half of dogs are properly vaccinated. [1] Studies have been performed on the cost-effectiveness of rabies vaccination programs as well as the most efficient ways to vaccinate dogs at most risk for contracting rabies. A retrospective study on the economic costs and effectiveness of Mexico's national rabies program found that 13,000 human lives were saved and incurred a cost of $300 million USD over 25 years which was acceptable when compared to the cost of care for those who would have been infected with rabies. [6] Another study was performed to determine the required number of stray dogs that would need to be vaccinated to reduce the spread of rabies. They found the required number of stray dog vaccinations is directly related to the total population of dogs in the area. [8]

The city of New Orleans and its suburbs are in Orleans Parish in Louisiana. Chapter 18 of the parish ordinances outline laws surrounding animals for the parish. Chapter 18-168 requires that "every dog or cat between three and four months old shall, at [the owner's] expense, have such dog or cat vaccinated by a Louisiana-licensed veterinarian with rabies vaccine." [3] The vaccine must be repeated in 12 months and then subsequently every 36 months. Section 18-169 requires the tag to be always affixed to the collar of the animal. [3] Even if the animal is receiving the vaccine every 3 years, the owner must purchase a new tag from their veterinarian each year. [3] Louisiana SPCA Humane Law and Rescue division is responsible for administering the rabies program for Orleans parish. They issue the tags to the veterinarians in the area and field calls placed to the number on the tags when an animal is found.

The objective of this project is not as broad as some of the other studies mentioned. The goal to take a microscopic look at the distribution of rabies tags in the Orleans Parish vaccination program to identify trends and optimize its management.

Which Data?

The spreadsheet used from the analysis contains data specifying tags issued to and returned from veterinary offices in Orleans Parish from 2015-2020. Fields included in the yearly distribution logs are:

- Starting tag number
- Ending tag number
- Delivered (date of the issue or return of tags)
- Volume (the number of tags)
- Returned (indicates the tags were returned)
- Clinic Name

Another worksheet contains demographic information for the clinics. Zip and city will be pulled into the dataset from this sheet.

Another spreadsheet contains phone log information from the phone number located on the tags in 2020. Graph analysis will be used to evaluate any correlation between areas, clinics and number of tags issued with the found reports from animals in the area. The categorical elements in this dataset are not standardized and have a high cardinality. The Louisiana SPCA will need to be consulted as a domain expert to translate some of the notes. They have already been contacted to see if call logs for more years can be sent for analysis.

Research Questions? Benefits? Why analyze these data?

Rabies vaccination programs offer more benefits than just mitigating the rabies occurrence in the community. It generates additional revenue for the agencies providing animal welfare services and can aid in the return of lost animals. The income from the Orleans Parish rabies tag program plugs a hole in the funding deficit from the city of New Orleans for animal control services provided by the Louisiana SPCA's Humane Law and Rescue team. In Ohio, a study performed in 2007 on the ways lost animals were recovered found that 18% of animals were recovered through a call from the rabies tag, and dogs that were wearing a license tag had a higher likelihood of recovery. [9]

For at least the last decade or more, this program has been managed manually with Excel spreadsheets and has not been organized or mined properly to provide meaningful analysis. Once the data in the spreadsheets is combined, can we optimize the number of rabies tags issued to each veterinary partner to reduce overhead, maximizing the number of tags created and reducing manpower required for drop off and deliveries? Efficiently managing this program can allow staff the time to work towards more vaccinations, increasing revenue from the program, and reuniting lost animals with their owners.

What Method?

Data cleaning and preparation will involve combining the multiple worksheets into one dataset and standardizing the data. The observations are currently stored as summaries of the volume of tags issued or returned on any given date. I will transform with data to provide the total number of tags issued each year for each clinic.

Tableau and R will be used to visualize the data for exploratory data analysis. A time series forecasting model based on moving averages over the years will be used to forecast the future values needed for each clinic. I'm currently evaluating potential models through Python to accomplish this. I will be researching classical time series algorithms through the statsmodel library as well as LSTM through the keras library.

Potential Issues?

Most of my projects completed have used classification algorithms; additional time will need to be spent learning and practicing time series forecasting models. As with any data science project, I also

may not be able to derive any meaning from the data provided or find any predictable variables that would aid the animal welfare community. As a data science student, the incorrect methods or approach may be used.

Concluding Remarks

The Louisiana SPCA's Humane Law and Rescue team performs vital services for Orleans Parish at a high-quality level with compassion. Based on the current funding allocated by the city of New Orleans, they respond to calls in the field 5 days a week and only emergencies around the clock. [7] Ideally, their officers should be responding to calls every day of the week, as they have in the past. Besides working towards the eradication of rabies in the area, efficient management of their rabies tag program can allow them generate more revenue.

References

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