Final Project-Research Article

Research Article

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Abstract

Celiotomy, commonly referred to as "colic surgery" is a type of surgery around the abdomin of a horse. According to the American College of Vetinary Surgeons, colic surgery is used to address many issues that affect the longevity of a horse, most commonly used to address issues within the gastrointestinal tract within the intestines. The surgery is also used to address a number of other lesions around the abdominal.

Introduction

Horses are regarded as powerful and courageous animal that are highly desired for riding, ranch work, jumping, racing, or dressage. As with any animal, there are always complications that may arise in regards to their health. This is especially true in horses. Horses can develop health problems at any stage in life and some are more susceptible to health problems than others. Our dataset focuses on horses who suffer from Colic. Colic is defined as having abdominal pains but in horses it is referred to problems in gastro-intestinal tract. Some common causes of Colic are High grain based diets/Low forage diets, Moldy/Tainted feed, Abrupt change in feed, Parasite infestation , Lack of water consumption leading to impaction colics, Sand ingestion, Long term use of NSAIDS, Stress and Dental problems. About 10% of horses die from colic which is why its important to understand variables that can contribute to their outcome.

Method(s)

1. Data collection
2. Data cleaning
3. Exploratory Data Analysis

Exploratory Data Analysis

Data Dictionary

Our data was sourced from the University of California, Irvine Machine Learning Repository.

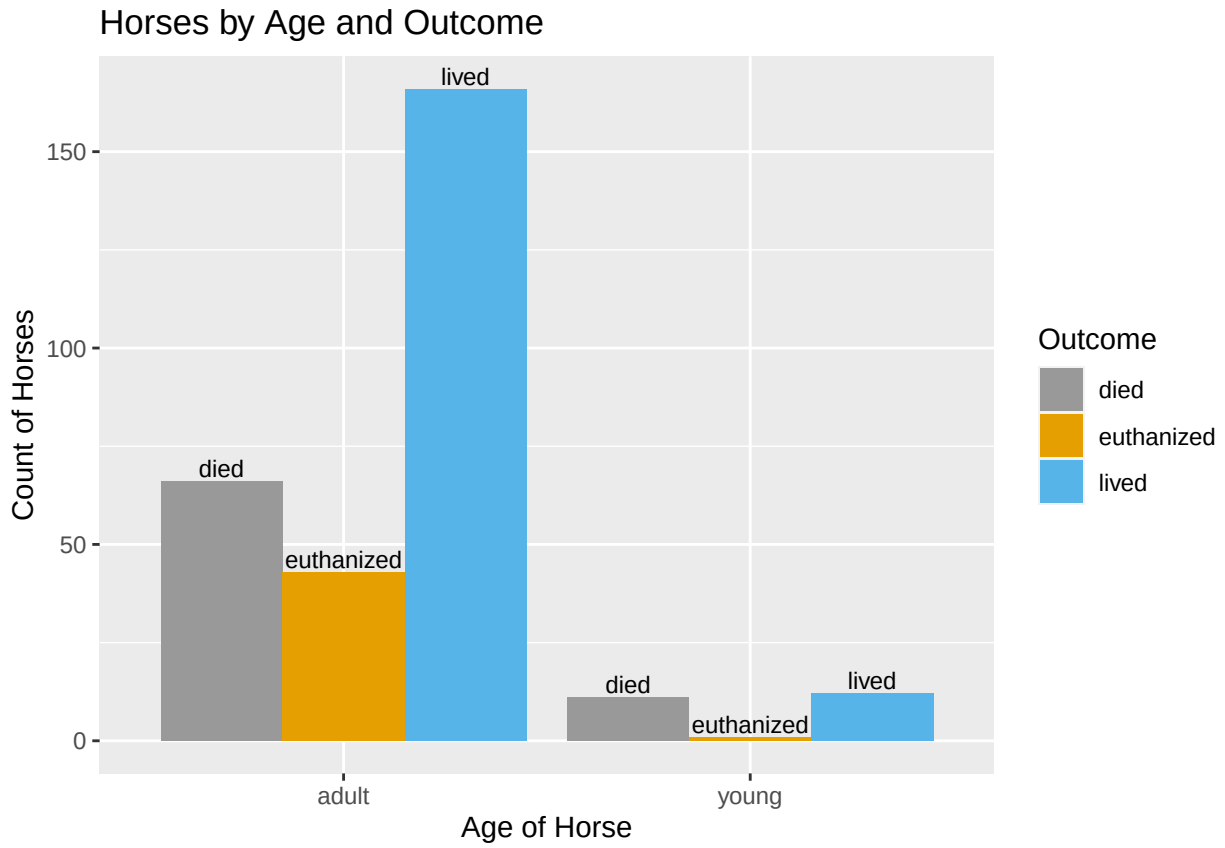
This specific dataset was donated August 6, 1989 by Will Taylor. It was created for use by Mary McLeish & Matt Cecile who belong to the Department of Computer Science at the University of Guelph in Guelph, Ontario, Canada.

The data has 299 observations and 27 parameters that range from continuous to discrete and nominal variables. Below you can find an outline of the variables found within the dataset as well as their respective description.

Variable Name	Description
ID	a row indicator which uniquely identifies each row
surgery	was the horse treated with or without surgery
age	identify if the horse in an adult or a child (young identified as under 6 months)
hospital_number	the case number assigned to the horse (same number if a horse is treated twice)
rectal_temp	the temperature of the horse's rectum recorded in degrees Celsius
pulse	a horse's heart rate measured in beats per minute

Variable Name	Description
respiratory_rate	the number of breaths a horse takes per minute
temp_of_extremities	a subjective way to measure the condition of outermost circulation by the temperature
peripheral_pulse	a subjective way to measure the condition of outermost circulation by pulse
mucous_membrane	a record of the color of the mucous membranes as an indicator of circulation
capillary_refill_time	measuring the time to refill the capillaries
pain	a measure of the horse's pain level (not to be taken as a linear variable)
peristalsis	an indication of the activity in the horse's gut
abdominal_distention	measure of the amount of air/gas filling the horse's gut as an indicator of a health problem
nasogastric_tube	amount of gas coming out of the nasogastric tube
nasogastric_reflux	the amount of reflux within the nasogastric tube
nasogastric_reflux_ph	ph of the reflux within the nasogastric tube
rectal_exam_feces	the amount of feces found within the rectal
abdomen	an indicator to how the abdomen (small and large intestine) is in relation to feces
packed_cell_volume	number of red cells in the blood by volume
total_protein	total amount of protein found in the blood
abdomo_appearance	the color of the fluid taken from the horse's abdominal cavity
abdomo_protein	total amount of protein found in the gut
outcome	current status of the horse: alive, dead, or euthanized
surgical_lesion	could the lesion and/or problem be treated with surgery
lesion_1	indicator of the site, type, subtype, specific code for lesion 1
lesion_2	indicator of the site, type, subtype, specific code for lesion 2
lesion_3	indicator of the site, type, subtype, specific code for lesion 3
cp_data	indicates if there is pathology data present

Horse Demographics



This graph shows number of horses by age groups and outcome which indicates horses' life status. The number of young horses (24) is very small so that it might not be enough to talk about the pattern. The bar graph shows that adult horses have higher lived proportion than young horses. Out of two hundred and seventy-five adult horses, one hundred and sixty-six (60%) horses have lived after treatment, whereas only 50% of young horses lived.

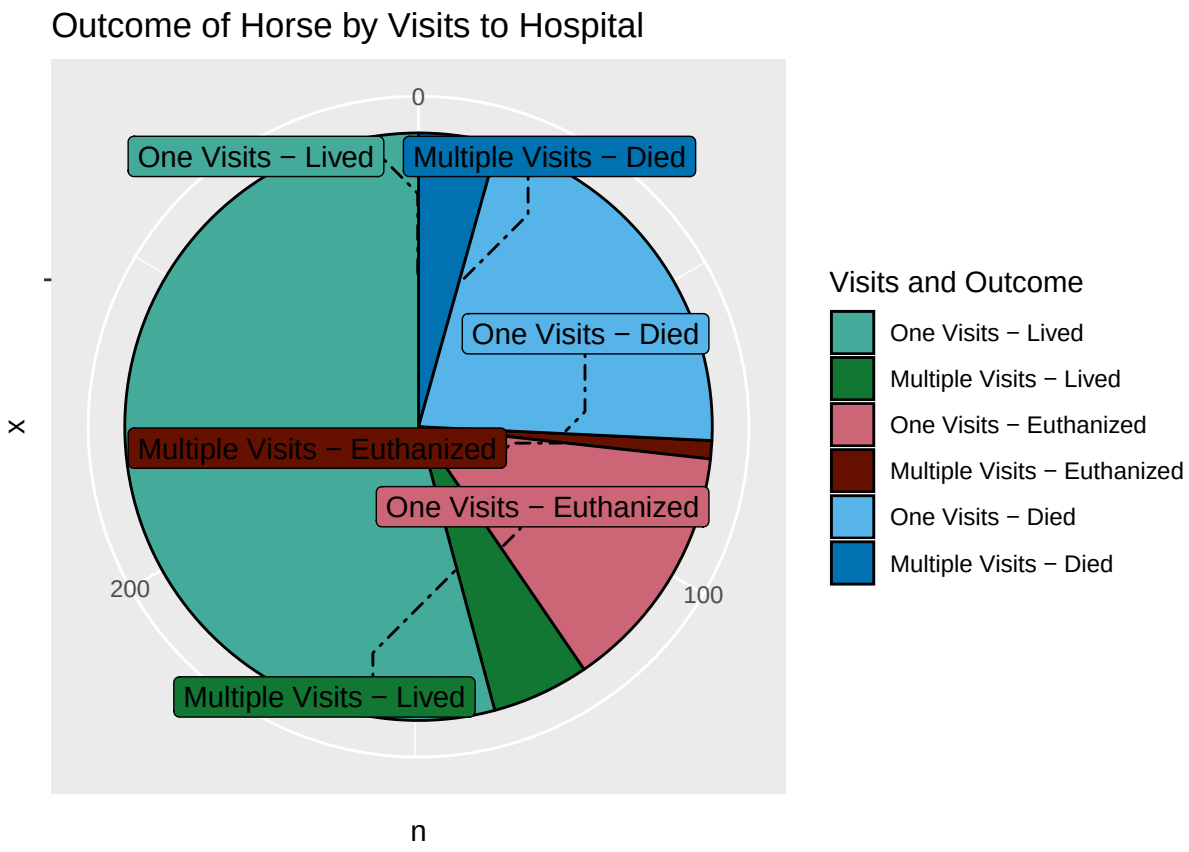
Hospital Demographics

There were 16 horses that has multiple treatments. Of those horses, we can see a breakdown of how many lived, died, or were euthanized.

outcome	n
died	7
euthanized	2
lived	8

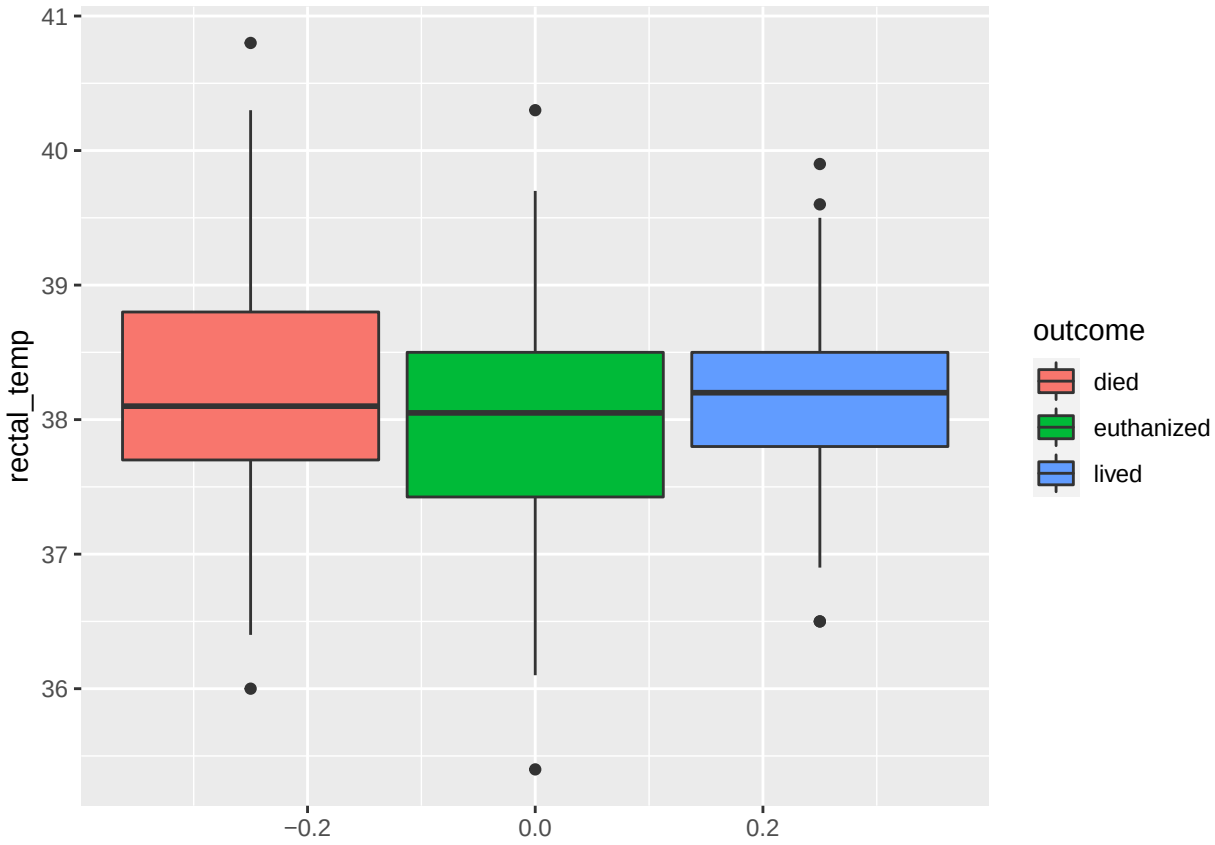
Comparing the horses that came back to the hospital numerous times to the horses that only visited once. We can see that there is a larger gap in the proportion of horses that need

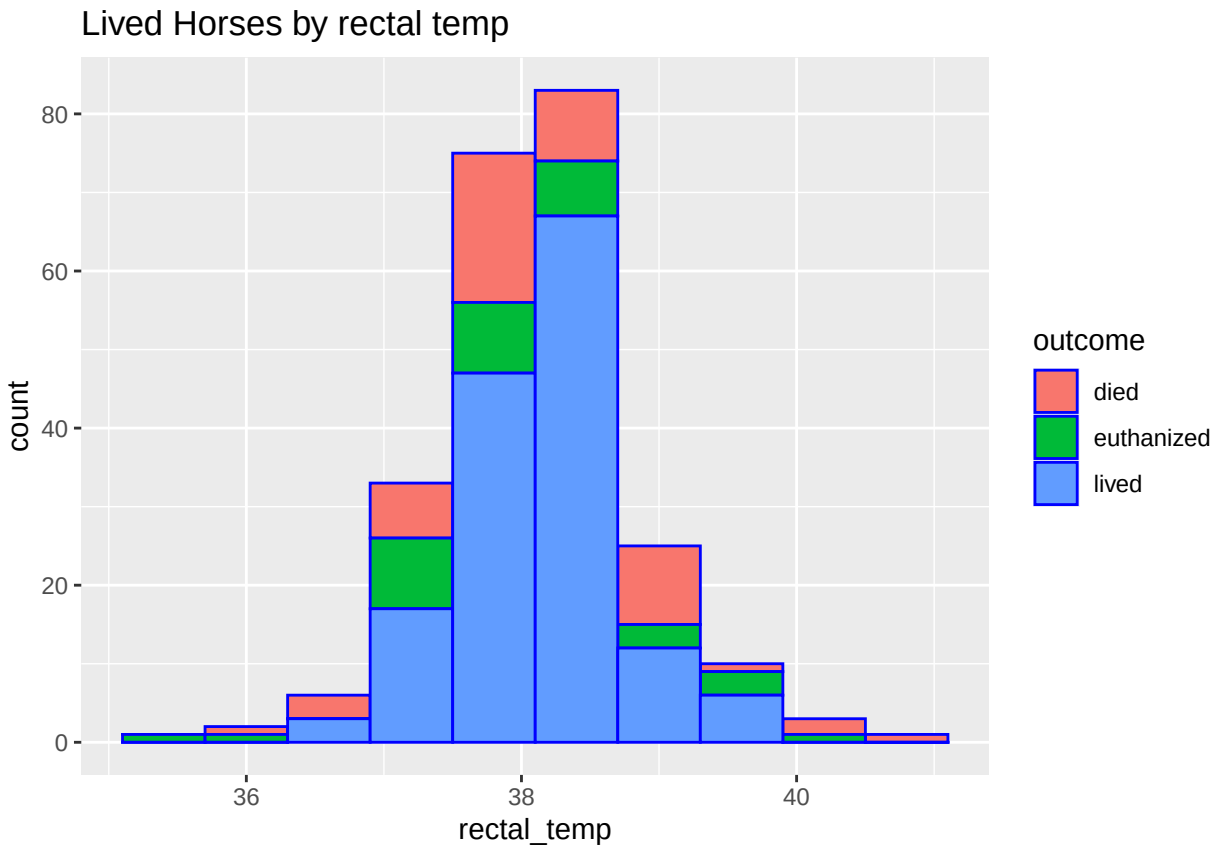
to be euthanized once returning to the hospital. The proportion of horses that returned to the hospital and were either euthanized or died (50%) is much larger than the proportion of horses that only went to the hospital once (39%). This helps to show that disregarding all other factors and demographics, if a horse was to return to the hospital, they had a 20% higher chance of being euthanize or dying.

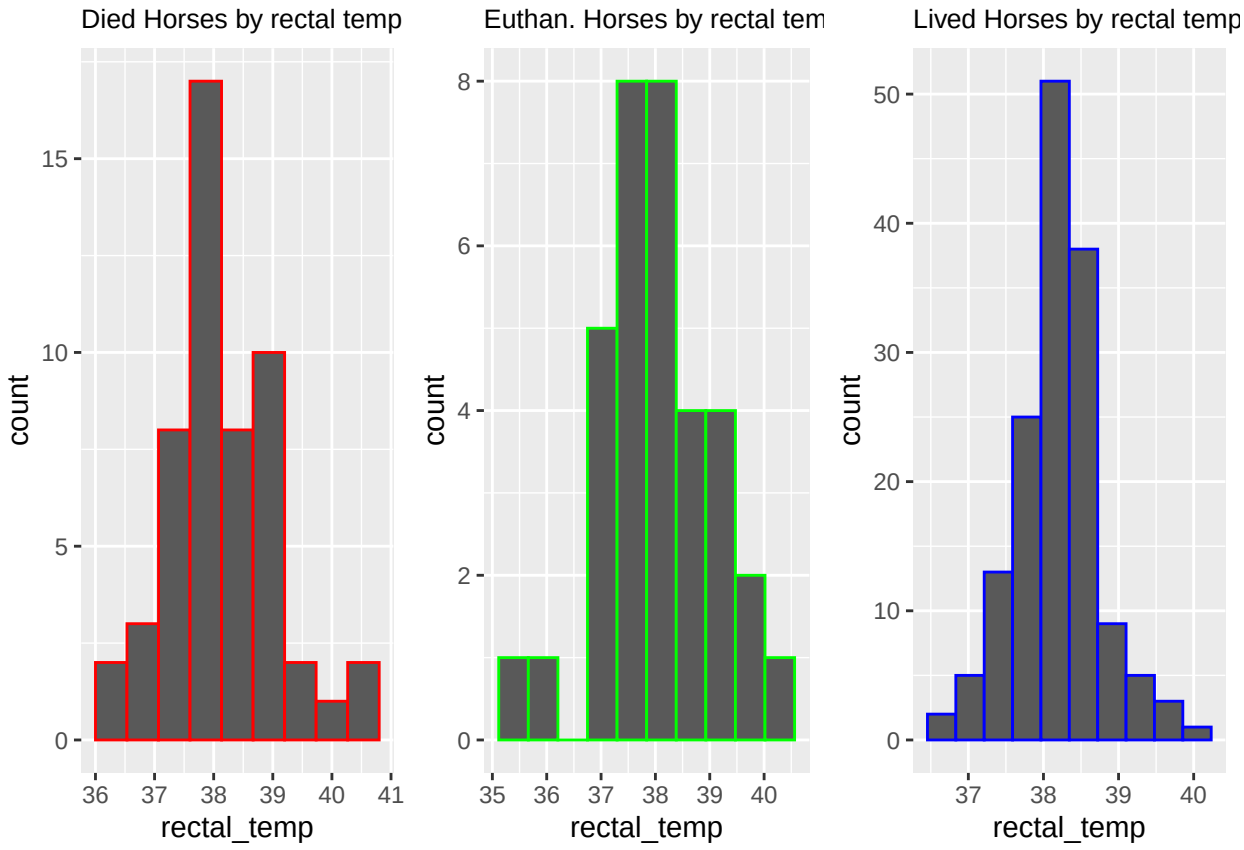


Physical Attributes

A normal rectal temperature for a horse sits around 37.8. A temperature above can come from an infection while a low temperature may be due to shock in the body.


41
40
39
38
37
36
rectal_temp
−0.2
0.0
0.2
outcome
died
euthanized
lived

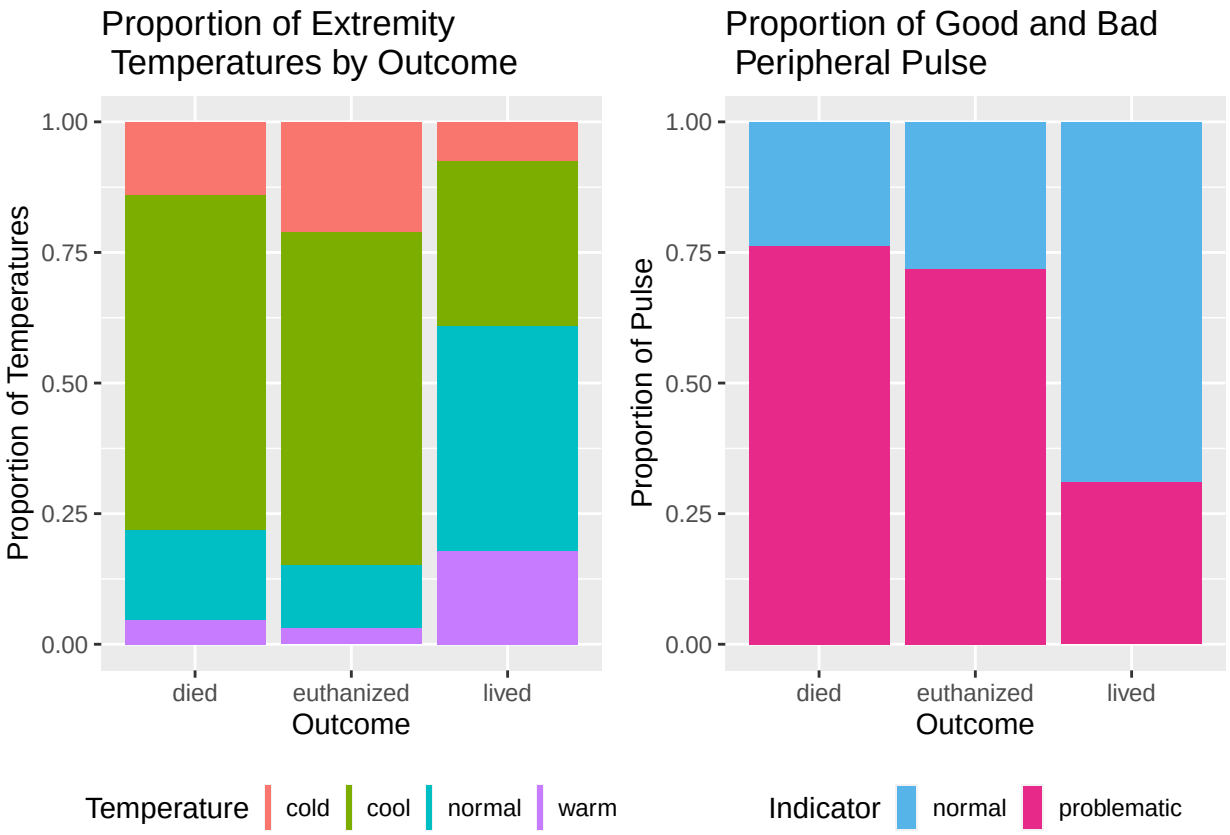

Lived Horses by rectal temp
count
80
60
40
20
0
36
38
40
rectal_temp
outcome
died
euthanized
lived

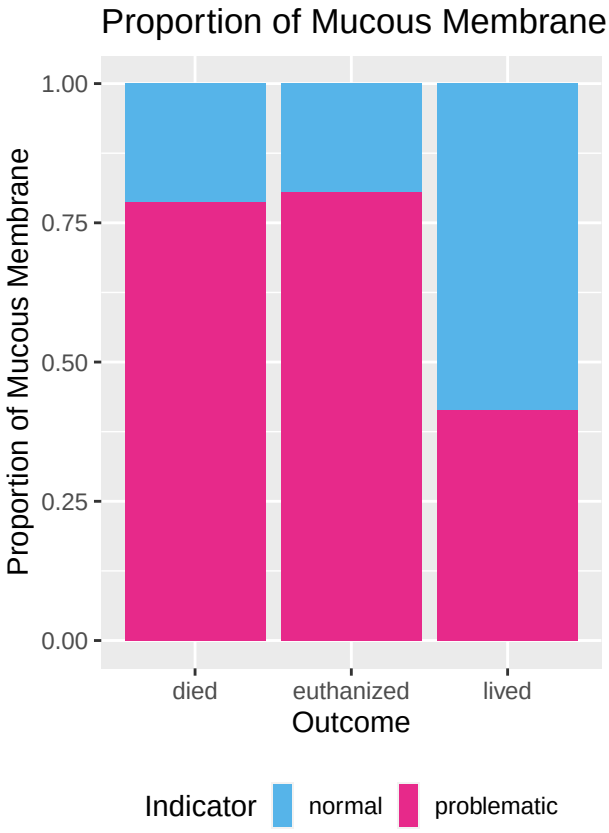


The average temperatures are similar between the three outcomes; died, euthanized, and lived, but temperatures of the horses which died are slightly higher with more cases (16%) ranging from 39 to 41 degree, and euthanized horses' temperaturesare lower than the other two in the range. There are higher variation for died and euthanized horses. The distribution for lived horses had more stable rectal temperatures than the other two groups.

Circulation Attributes

Cold and Cool temperatures are associated with possible shock of the horse, while hotter extremities (in this case denoted as 'Warm') are associated with elevated rectal temperatures. Both cases signal that there is an underlying health issue with the horse.


Proportion of Extremity Temperatures by Outcome
Proportion of Temperatures
1.00
0.75
0.50
0.25
0.00
died
euthanized
lived
Outcome
Temperature
cold
cool
normal
warm
Proportion of Good and Bad Peripheral Pulse
Proportion of Pulse
1.00
0.75
0.50
0.25
0.00
died
euthanized
lived
Outcome
Indicator
normal
problematic



Peripheral Pulse is a measure of how fast blood, in the outermost parts of the horse, is moving away from the heart way and is being used to measure the horse's circulation. A normal or increased peripheral pulse is considered normal, however, a reduced or absent pulse in an indicator of poor circulation.

The Mucos Membrane color can also be an indicator of poor circulation and lead to an earlier admittion into the hospital. The following table denotes the meaning beind the colors;

Color	**Meaning**
Normal Pink	indicate a normal or slightly increased circulation
Bright Pink	indicate a normal or slightly increased circulation
Pale Pink	occurs in early stages of shock
Pale Cyanotic	indicates of a serious circulatory issue
Bright Red/Injected	indicates septicemia
Dark Cyanotic	indicates of a serious circulatory issue

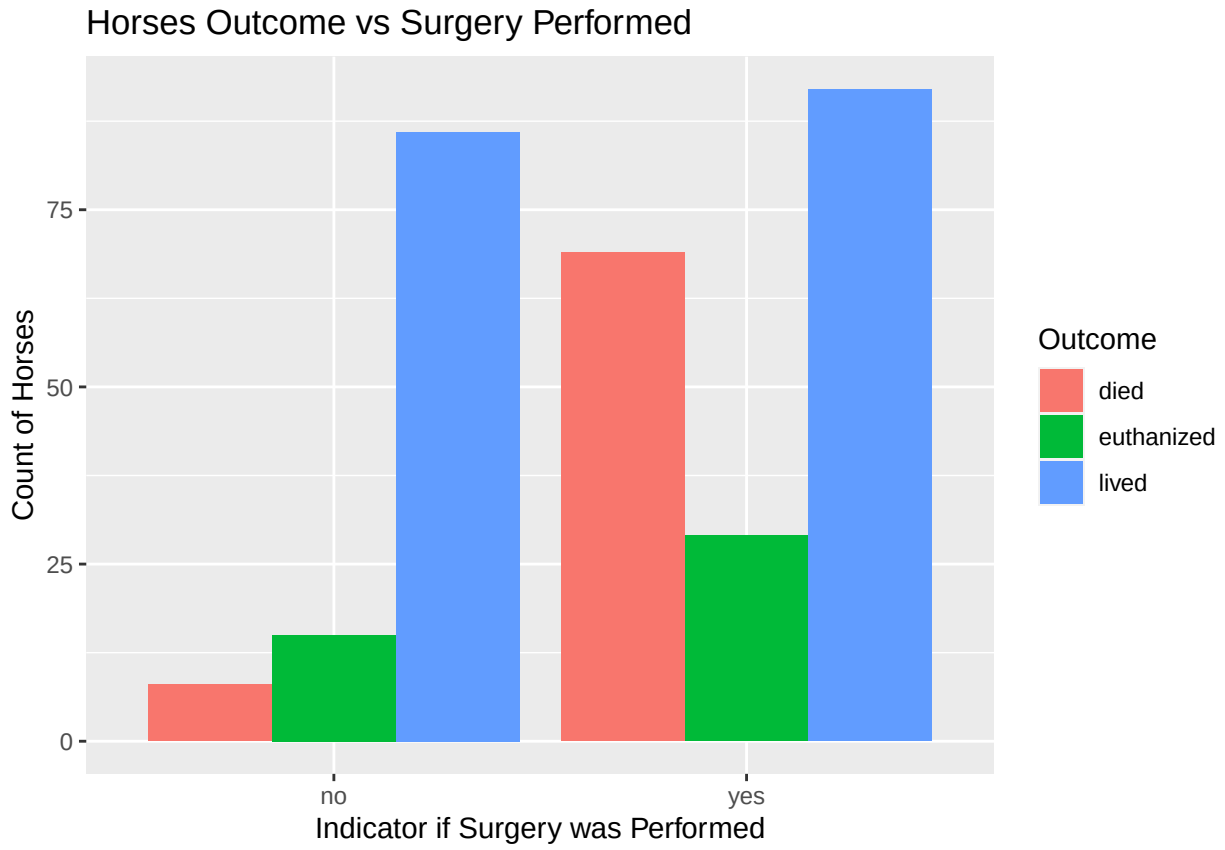
capillary refill time The longer the refill, the poorer the circulation

Pain Attributes

	died	euthanized	lived	Sum
alert	2	1	35	38
depressed	14	12	33	59
extreme_pain	24	6	12	42
mild_pain	8	5	54	67
severe_pain	17	11	10	38
Sum	65	35	144	244

This two way table states that the more pain a horse has, it is less likely to be "lived" than "died" or "euthanized". For example, when horses feel extreme pain, there are only 1/3 of horses to be "lived" when the other 2/3 were either "died" or "euthanized". However, when horses alert status, over 90% of horses to be "lived".

Outcome Analysis



This table provides some input to the most common lesions found on horses and an analysis to compare the horses demographics of age, outcome and if they had surgery in respect to the place of the lesion.

age	outcome	surgery	lesion_1	Freq
adult	lived	no	0	45
adult	lived	no	3111	16
adult	lived	yes	3111	12
adult	euthanized	yes	3205	11
adult	lived	yes	2208	10
adult	died	yes	3205	9
adult	lived	yes	0	7
adult	lived	no	400	5
adult	lived	yes	2124	5
adult	died	yes	2205	5

Conclusions

From the horse demographics, we have found that even though there is a very small number of young horses, there is a higher "lived" adult horse proportion than young horses. This might be due to adult horses having more robust health system to recover from surgeries and illness. Horse's hospital demographics show that if a horse was to return to the hospital, they had a 20% higher chance of being euthanized or dying. Those who lived have three times higher proportions (around 60%) of normal and warm temperatures than those who died or euthanized (18~20%). About 70% of lived horses had normal peripheral pulse and about 70% of died or euthanized horses had problematic peripheral pulses. The distribution for lived horses had more stable rectal temperatures than the other two groups. About 60% of the lived horses had normal circulation when about 20~25% of the died or euthanized horses had normal circulation. This two way table states that the more pain a horse has, it is less likely to be "lived" than "died" or "euthanized".

Bibliography and References

Colic emergencies " large animal hospital " College of veterinary medicine " University of Florida. (n.d.). Retrieved May 28, 2021, from https://largeanimal.vethospitals.ufl.edu/hospital-services/surgery/colic/

Colic Surgery in Horses. (n.d.). Retrieved from https://www.acvs.org/surgical-procedures/colic-surgery-horses