

Team_Project

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Team Name: i need a </br>

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1) Abstract

Celiotomy, commonly referred to as “colic surgery” is a type of surgery around the abdomen of a horse. According to the American College of Veterinary 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.

2) 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 gastrointestinal 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 given that the horse underwent Colic Surgery.

3) Method(s)

1. Data Collection
2. Exploratory Data Analysis

4) Data

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 is 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
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

```
#####
#####
#####
options(stringsAsFactors=FALSE, width=200)
projpath <- getwd()
if(!exists("xdbsock")) {
  xdbsock <- ""
  cat("\n", "Parameter 'xdbsock' not found, setting to empty string for general usage", "\n")
}
```

```
##
## Parameter 'xdbsock' not found, setting to empty string for general usage
```

```
library(RMySQL)
```

```
## Loading required package: DBI
```

```
library(rjson)
drv <- dbDriver("MySQL")
#####
#####
xdbuser <- Sys.getenv("MAS405_AWS_YOLANDA_DB_RO_USER")
xpw      <- Sys.getenv("MAS405_AWS_YOLANDA_DB_RO_PW")
xdbname  <- Sys.getenv("MAS405_AWS_YOLANDA_DB_RO_DBNAME")
xdbhost  <- Sys.getenv("MAS405_AWS_YOLANDA_DB_RO_HOST")
xdbport  <- as.integer( Sys.getenv("MAS405_AWS_YOLANDA_DB_RO_PORT") )
con <- dbConnect(drv, user=xdbuser, password=xpw, dbname=xdbname, host=xdbhost, port=xdbport, unix.sock=)
##### get info
dbListTables(con)
```

```
## [1] "dataDictionary" "horse"
```

```
dbGetInfo(con)
```

```
## $host
## [1] "stats405db.cziy0a015m5d.us-east-1.rds.amazonaws.com"
##
## $user
## [1] "R0user"
##
## $dbname
## [1] "db1"
##
## $conType
## [1] "stats405db.cziy0a015m5d.us-east-1.rds.amazonaws.com via TCP/IP"
##
## $serverVersion
## [1] "8.0.23"
##
## $protocolVersion
## [1] 10
##
## $threadId
## [1] 18978
##
## $rsId
## list()
```

```
qstr <- "SHOW TABLES"
xx <- dbGetQuery(con, qstr)
xx
```

```
##      Tables_in_db1
## 1 dataDictionary
## 2          horse
```

```
query1 <- "select * from horse"
result1 <- dbGetQuery(con, query1)

head(result1)
```

##	ID	surgery	age	hospital_number	rectal_temp	pulse	respiratory_rate	temp_of_extremities	peripheral
## 1	1	no	adult	530101	38.5	66	28	cool	r
## 2	2	yes	adult	534817	39.2	88	20	<NA>	
## 3	3	no	adult	530334	38.3	40	24	normal	r
## 4	4	yes	young	5290409	39.1	164	84	cold	r
## 5	5	no	adult	530255	37.3	104	35	<NA>	
## 6	6	no	adult	528355	NA	NA	NA	warm	r
##	nasogastric_tube		nasogastric_reflux		nasogastric_reflux_ph		rectal_exam_feces		abdomen
## 1		<NA>		<NA>		NA	decreased	distend_large	
## 2		<NA>		<NA>		NA	absent	other	
## 3		<NA>		<NA>		NA	normal	normal	
## 4		none		less_1_liter		5	decreased	<NA>	
## 5		<NA>		<NA>		NA	<NA>	<NA>	
## 6		slight		none		NA	decreased	firm	
##	lesion_2	lesion_3	cp_data						
## 1	0	0	no						
## 2	0	0	no						
## 3	0	0	yes						
## 4	0	0	yes						
## 5	0	0	no						
## 6	0	0	no						

```
knitr::kable(summary(result1))
```

ID	surgey	hospital	plurality	stage	type	of	primary	site	in	breast	site	in	basal	dis	in	site	in	depth	of	path	in	bone	comp	with	in	dis	in	2p	3data	
MinLength:	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
:	:	:	35.40	:	:	:	:	:	:	:	:	:	:	:	1.00	:	:	23.00	:	:	:	:	:	:	:	:	:	:	:	
1.0	518476	30	8.00	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3.30	:	:	:	0.10	:	:	:	0	0.000.000	:	:	
1st Class	Class	1st	1st	1st	1st	Class	Class	Class	Class	Class	Class	Class	Class	Class	1st	Class	Class	1st	Class	1st	Class	1st	Class	1st	1st	1st	1st	1st	1st	Class
Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character	Qu.:character
75.5	528904	48	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	6.50	:	:	:	2.00	:	:	:	2112	0.000.000	:	:	
MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	MedMod	
:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character	:150:character
530301	64	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	7.50	:	:	:	2.30	:	:	:	2322	0.000.000	:	:	
MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA	MeanNA
:150.0	:108.77	38.37	:30.46	:	:	:	:	:	:	:	:	:	:	:	:	:	:	4.83	:	:	:	46.31	24.27	:	:	:	:	:	:	
72	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3.04	:	:	:	3660	0.53.388	:	:	
3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	3rd NA	
Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5	Qu.:224.5
534736	88	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	3.90	:	:	:	3.20	:	:	:	3209	0.000.000	:	:	

ID	surgery	hospital	number	age	rectal	temp	pulse	respiratory	rate	temp	of	extremities	peripheral	pulse	mucous	membrane	capillary	refill	time	pain	peristalsis	abdominal	distention	nasogastric	tube	nasogastric	reflux	nasogastric	reflux	ph	rectal	exam	feces	abdomen	packed	cell	volume	total	protein	abdomo	appearance	abdomo	protein	outcome	surgical	lesion	lesion_1	lesion_2	lesion_3	cp_data																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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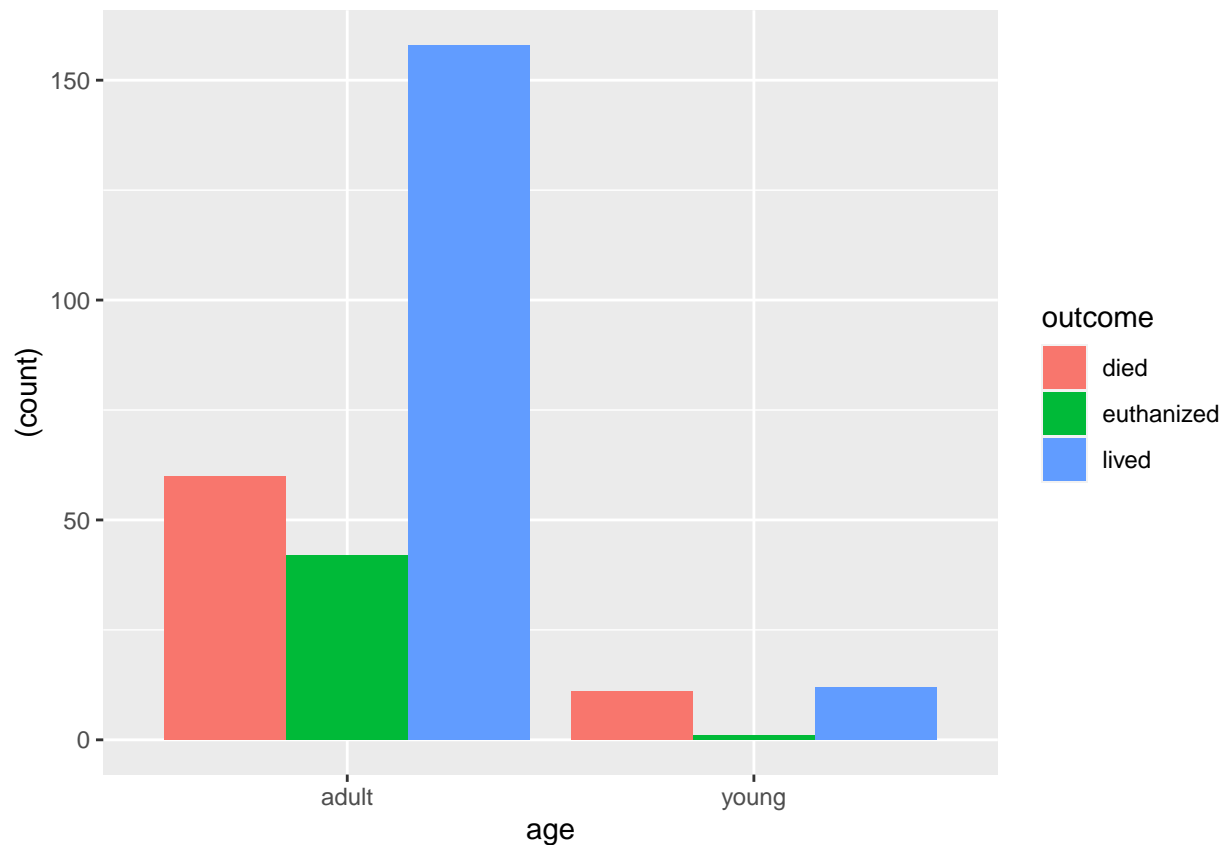
```
str(result1)
```

```
## 'data.frame':    299 obs. of  29 variables:
## $ ID              : int  1 2 3 4 5 6 7 8 9 10 ...
## $ surgery         : chr  "no" "yes" "no" "yes" ...
## $ age             : chr  "adult" "adult" "adult" "young" ...
## $ hospital_number : int  530101 534817 530334 5290409 530255 528355 526802 529607 530051 529961
## $ rectal_temp     : num  38.5 39.2 38.3 39.1 37.3 NA 37.9 NA NA 38.3 ...
## $ pulse           : int  66 88 40 164 104 NA 48 60 80 90 ...
## $ respiratory_rate : int  28 20 24 84 35 NA 16 NA 36 NA ...
## $ temp_of_extremities : chr  "cool" NA "normal" "cold" ...
## $ peripheral_pulse : chr  "reduced" NA "normal" "normal" ...
## $ mucous_membrane  : chr  NA "pale_cyanotic" "pale_pink" "dark_cyanotic" ...
## $ capillary_refill_time: chr  "more_3_sec" "less_3_sec" "less_3_sec" "more_3_sec" ...
## $ pain             : chr  "extreme_pain" "mild_pain" "mild_pain" "depressed" ...
## $ peristalsis      : chr  "absent" "absent" "hypomotile" "absent" ...
## $ abdominal_distention : chr  "severe" "slight" "none" "severe" ...
## $ nasogastric_tube  : chr  NA NA NA "none" ...
## $ nasogastric_reflux : chr  NA NA NA "less_1_liter" ...
## $ nasogastric_reflux_ph: int  NA NA NA 5 NA NA NA NA NA NA ...
## $ rectal_exam_feces : chr  "decreased" "absent" "normal" "decreased" ...
## $ abdomen          : chr  "distend_large" "other" "normal" NA ...
## $ packed_cell_volume : int  45 50 33 48 74 NA 37 44 38 40 ...
## $ total_protein     : num  8.4 85 6.7 7.2 7.4 NA 7 8.3 6.2 6.2 ...
## $ abdomo_appearance : chr  NA "cloudy" NA "serosanguinous" ...
## $ abdomo_protein    : num  NA 2 NA 5.3 NA NA NA NA NA 2.2 ...
## $ outcome           : chr  "died" "euthanized" "lived" "died" ...
## $ surgical_lesion   : chr  "no" "no" "no" "yes" ...
## $ lesion_1          : int  11300 2208 0 2208 4300 0 3124 2208 3205 0 ...
## $ lesion_2          : int  0 0 0 0 0 0 0 0 0 0 ...
## $ lesion_3          : int  0 0 0 0 0 0 0 0 0 0 ...
## $ cp_data           : chr  "no" "no" "yes" "yes" ...
```

There is no column that represents a unique horse in the table. We tried to retrieve the number of horses by counting the distinct hospital_number which is their case number and they have the same case number when the horses are treated multiple times.

```
library(ggplot2)
query2 <- "select distinct age,outcome, hospital_number from horse"
result2 <- dbGetQuery(con, query2)

ggplot(data=result2,aes(x=age,fill=outcome)) +
  geom_bar(aes(y=(..count..)),position=position_dodge())
```



```
query2_1 <- "select age,outcome,count(*) cnt from horse group by age,outcome"
result2_1 <- dbGetQuery(con, query2_1)
```

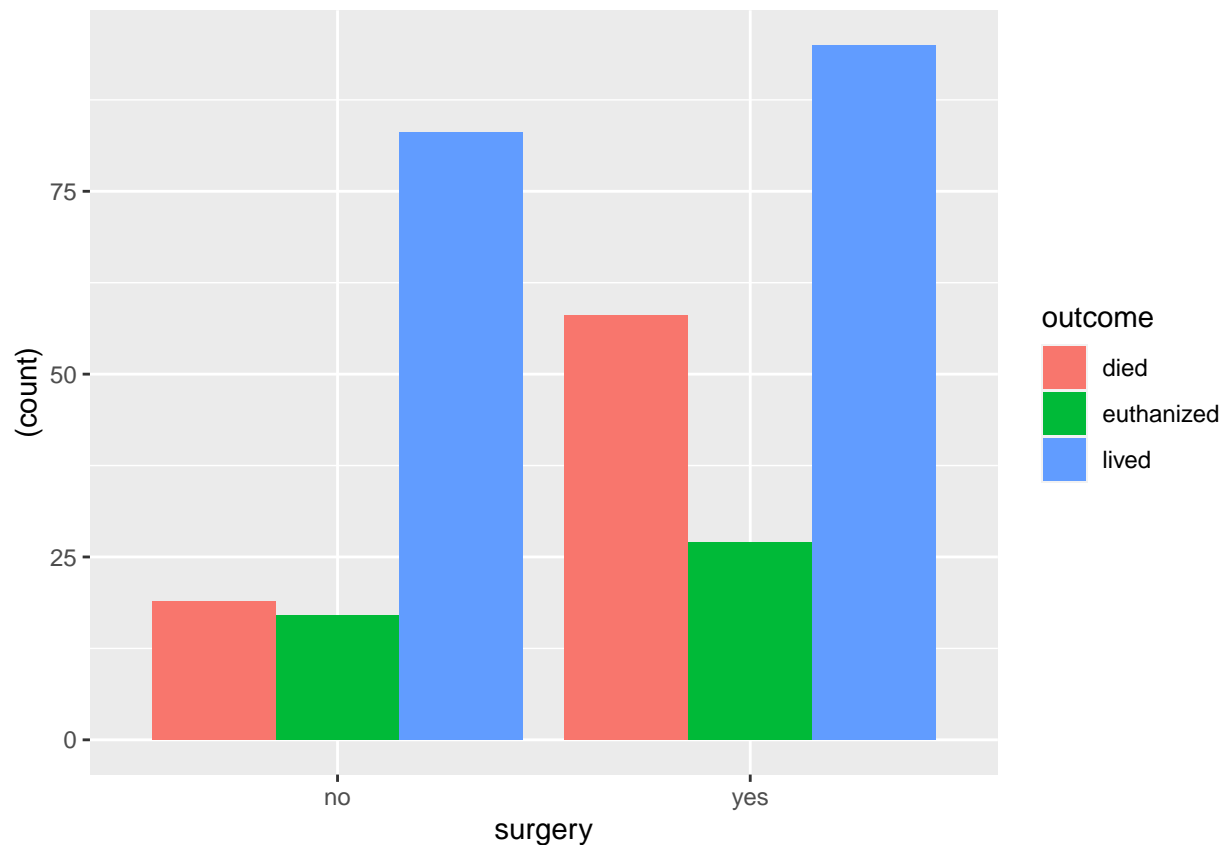
```
knitr::kable(table(result2$age,result2$outcome))
```

	died	euthanized	lived
adult	60	42	158
young	11	1	12

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.

```
query3 <- "select surgery,outcome from horse"
result3 <- dbGetQuery(con, query3)
```

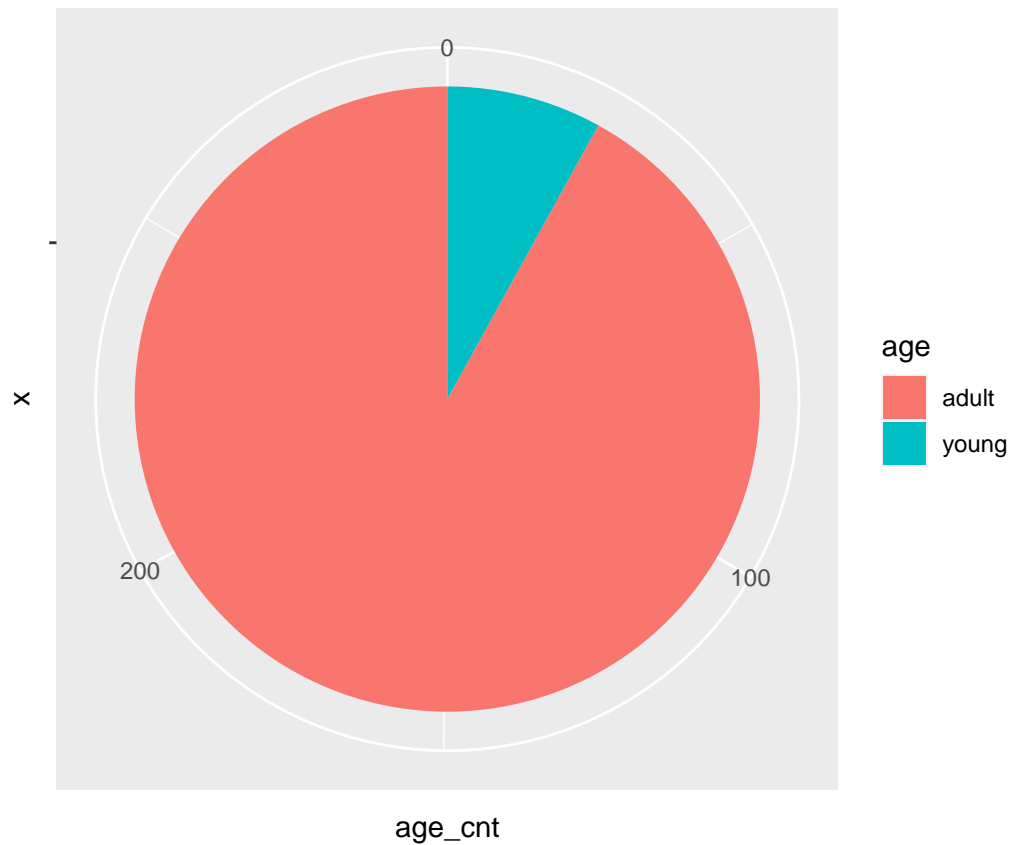
```
ggplot(data=result3,aes(x=surgery,fill=outcome)) +
  geom_bar(aes(y=(..count..)),position=position_dodge())
```



The graph shows the outcome of horses, either died, lived, or euthanized based on whether a surgery treatment was applied. There are 119 observations for no surgery, and 180 for surgery. 70% of the horses without surgery survived. For horses who had surgery, around 53% lived, and 32% have died.

```
query4_1 <- "select age,count(age) age_cnt from horse group by age"
result4_1 <- dbGetQuery(con, query4_1)
```

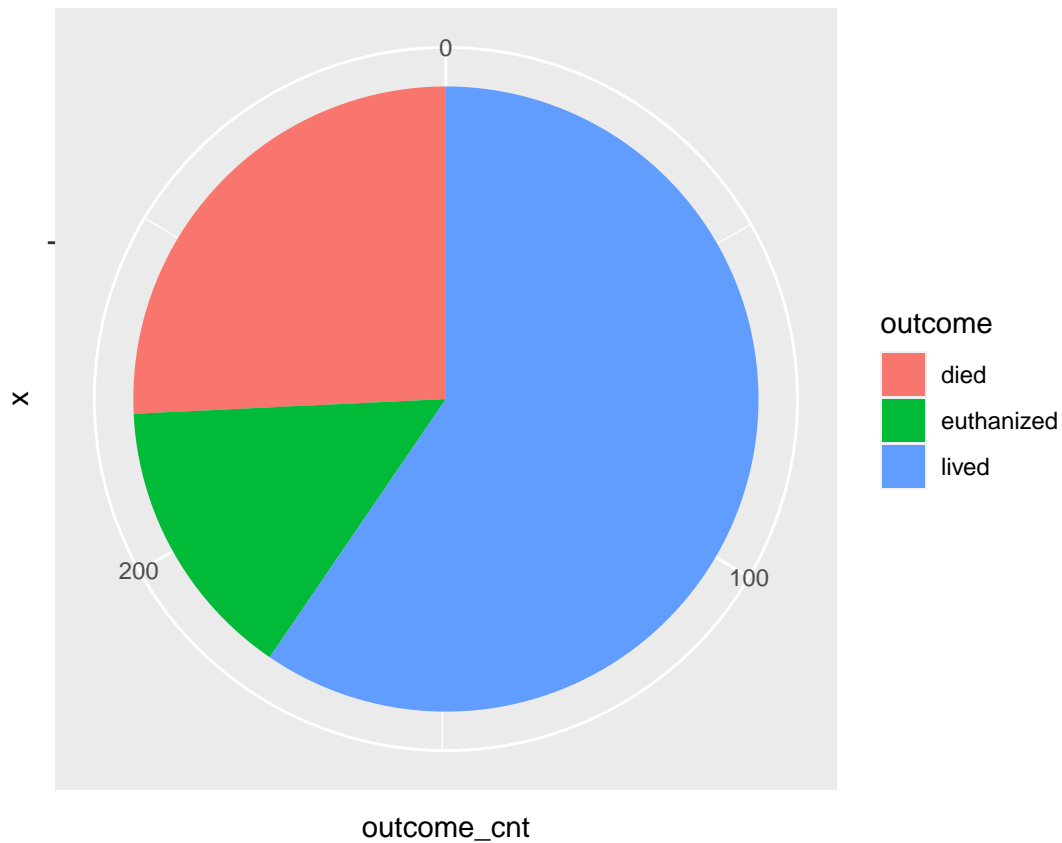
```
ggplot(result4_1,aes(x="",y=age_cnt,fill=age)) + geom_bar(stat="identity",width=1) +
  coord_polar("y",start=0)
```



```
knitr::kable(result4_1)
```

age	age_cnt
adult	275
young	24

```
query4_2 <- "select outcome,count(outcome) outcome_cnt from horse group by outcome"
result4_2 <- dbGetQuery(con, query4_2)
ggplot(result4_2,aes(x="",y=outcome_cnt,fill=outcome )) + geom_bar(stat="identity",width=1) +
  coord_polar("y",start=0)
```

```
knitr::kable(result4_2)
```

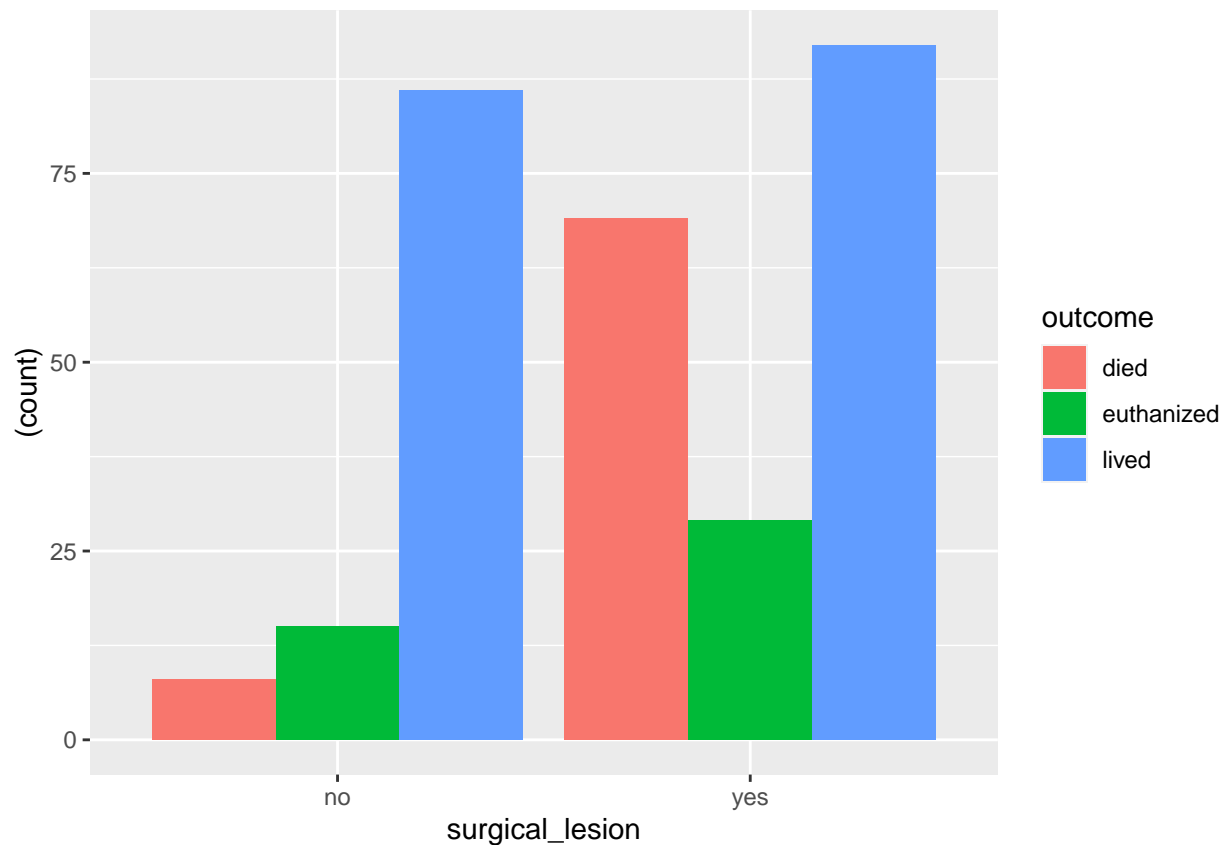
outcome	outcome_cnt
died	77
euthanized	44
lived	178

```
query5 <- "select outcome,surgical_lesion from horse"
result5 <- dbGetQuery(con, query5)
```

```
head(result5)
```

```
##      outcome surgical_lesion
## 1      died              no
## 2 euthanized              no
## 3      lived              no
## 4      died              yes
## 5      died              no
## 6      lived              no
```

```
ggplot(data=result5,aes(x=surgical_lesion,fill=outcome)) +
  geom_bar(aes(y=(..count..)),position=position_dodge())
```



```
knitr::kable(table(result5$outcome,result5$surgical_lesion))
```

	no	yes
died	8	69
euthanized	15	29
lived	86	92

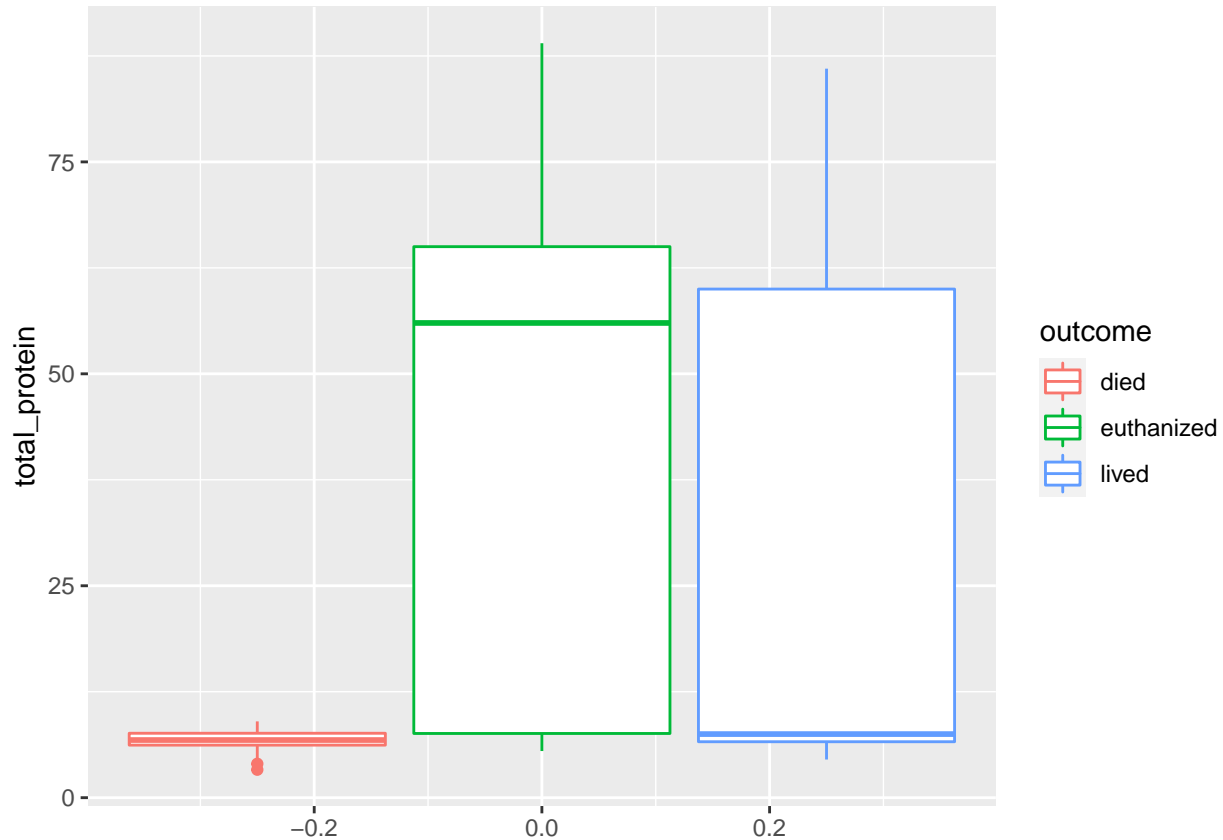
```
query6 <- "select id,total_protein,outcome from horse"
result6 <- dbGetQuery(con, query6)
```

```
head(result6)
```

```
##   id total_protein  outcome
## 1  1         8.4      died
## 2  2        85.0 euthanized
## 3  3         6.7      lived
## 4  4         7.2      died
## 5  5         7.4      died
## 6  6          NA      lived
```

```
result6$outcome<-as.factor(result6$outcome)
ggplot(data =result6, aes(y=total_protein,color=outcome)) +
  geom_boxplot(notch=F)
```

```
## Warning: Removed 33 rows containing non-finite values (stat_boxplot).
```



```
#knitr::kable(result6$total_protein,result6$outcome)
```

```
library(dplyr)
```

```
##
```

```
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
```

```
##
```

```
## filter, lag
```

```
## The following objects are masked from 'package:base':
```

```
##
```

```
## intersect, setdiff, setequal, union
```

```
query6_1 <- "select outcome,avg(total_protein) mean_protein,STDDEV_SAMP(total_protein) sd, count(distinct outcome) count_outcome from horse"
result6_1 <- dbGetQuery(con, query6_1)
```

```
#Protein in the guts
```

```
# query6_2 <- "select id,abdomo_protein,outcome from horse"
```

```
# result6_2 <- dbGetQuery(con, query6_2)
```

```
#
```

```
# ggplot(data =result6_2, aes(y=abdomo_protein,color=outcome)) +
#   geom_boxplot(notch=F)
```

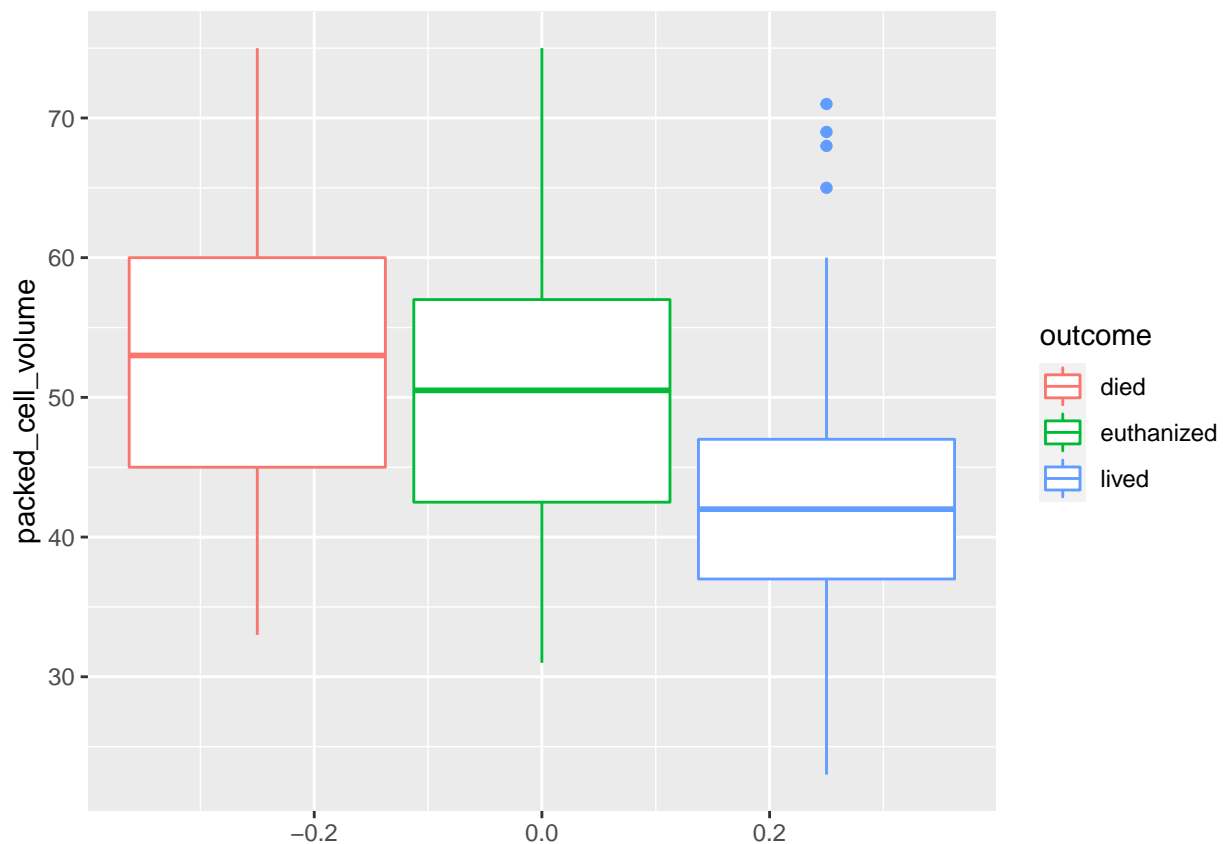
```
knitr::kable(as.data.frame(result6_1))
```

outcome	mean_protein	sd	horse_cnt
died	6.844615	1.177661	77
euthanized	42.038889	30.705228	44
lived	27.264848	28.452084	178

```
query7 <- "select id,packed_cell_volume,outcome from horse"
result7 <- dbGetQuery(con, query7)
```

```
ggplot(data =result7, aes(y=packed_cell_volume,color=outcome)) +
  geom_boxplot()
```

```
## Warning: Removed 29 rows containing non-finite values (stat_boxplot).
```



```
result7 %>% group_by(outcome) %>% summarize(mean = mean(packed_cell_volume,na.rm=T),
      sd = sd(packed_cell_volume,na.rm=T),
      count = length(packed_cell_volume))
```

```
## # A tibble: 3 x 4
```

```
##   outcome    mean    sd count
## * <chr>      <dbl> <dbl> <int>
## 1 died       52.5 11.4    77
## 2 euthanized  50.8 11.4    44
## 3 lived      42.7  7.97   178
```

```
# Display two-way table for Pain and Outcome
library(pander)
query9 <- "SELECT * FROM db1.horse;"
result9 <- dbGetQuery(con, query9)
twoWay_Pain_Outcome <- pander(table(result9$pain, result9$outcome))
twoWay_Pain_Outcome
```

	died	euthanized	lived
alert	2	1	35
depressed	14	12	33
extreme_pain	24	6	12
mild_pain	8	5	54
severe_pain	17	11	10

```
# Display two-way table for abdominal distention and Outcome
query10 <- "SELECT * FROM db1.horse;"
result10 <- dbGetQuery(con, query10)
twoWay_abdominal_distention_Outcome <- pander(table(result10$abdominal_distention, result10$outcome))
twoWay_abdominal_distention_Outcome
```

	died	euthanized	lived
moderate	27	12	26
none	7	7	61
severe	15	10	13
slight	14	4	47

```
# Display two-way table for nasogastric reflux and Outcome
query11 <- "SELECT * FROM db1.horse;"
result11 <- dbGetQuery(con, query11)
twoWay_nasogastric_reflux_Outcome <- pander(table(result11$nasogastric_reflux, result10$outcome))
twoWay_nasogastric_reflux_Outcome
```

	died	euthanized	lived
less_1_liter	14	5	16
more_1_liter	14	10	15
none	22	17	80

5) Conclusions

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>