

Exploring Pediatric Appendicitis

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Introduction

In 2015, approximately 11.6 million cases of appendicitis were reported, resulting in around 50,100 deaths worldwide. Also appendicitis is one of the most common and significant causes of sudden abdominal pain, So diagnosing and treating this disease should be made as quickly as possible. There are many criteria to do so such as taking a history, physical examination, risk scores (e.g Alvarado Score) and imaging techiques like ultra-sonography and CT.

The cost of the diagnosis could be improved for example using US instead of CT, accuracy could be also improved using Machine learning. One recent study built a model to predict appendicitis in pediatrics using Interpretable unsupervised machine learning method.

Since a lot of models has been built using just history and physical examinatin as predictors, we would use the same dataset to explore the disease for a bit then build models that focus on ultra-sonography as a way to diagnose appendicitis.

Methodology

- Taking a look at the data

Table 1: First Ten Rows of the Pediatric Appendicitis Dataset

Sex	US__Performed	Severity	Management	Diagnosis
male	yes	uncomplicated	conservative	appendicitis
male	yes	uncomplicated	conservative	appendicitis
male	yes	uncomplicated	primary surgical	appendicitis
female	yes	uncomplicated	conservative	appendicitis
male	yes	uncomplicated	conservative	appendicitis
female	yes	complicated	primary surgical	appendicitis
female	yes	uncomplicated	conservative	no appendicitis
male	yes	uncomplicated	conservative	no appendicitis
male	yes	uncomplicated	conservative	no appendicitis
male	yes	uncomplicated	conservative	no appendicitis

Some Plots

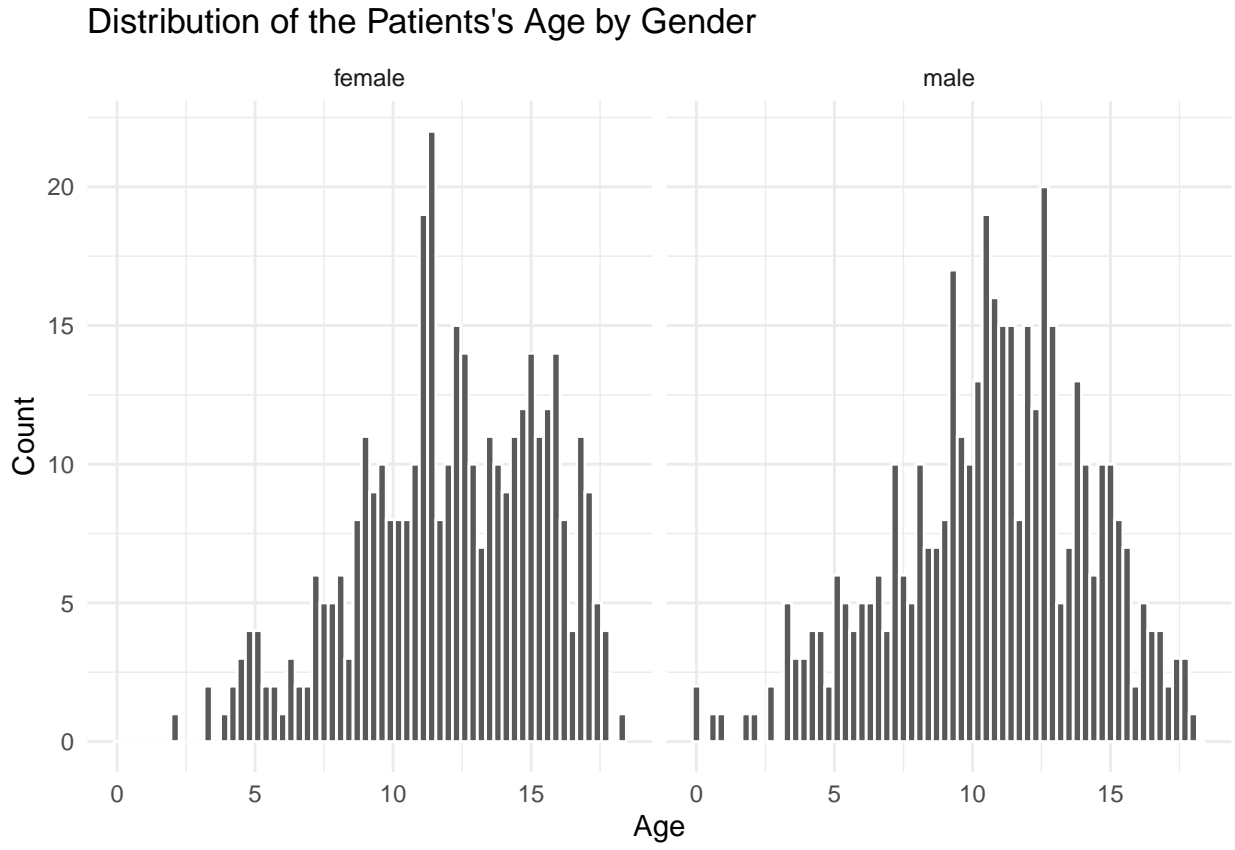


Figure 1: Distribution of the Patients's Age by Gender

Table 2: The Mean Age of Patients By Gender

Sex	Mean
female	12.06
male	10.68

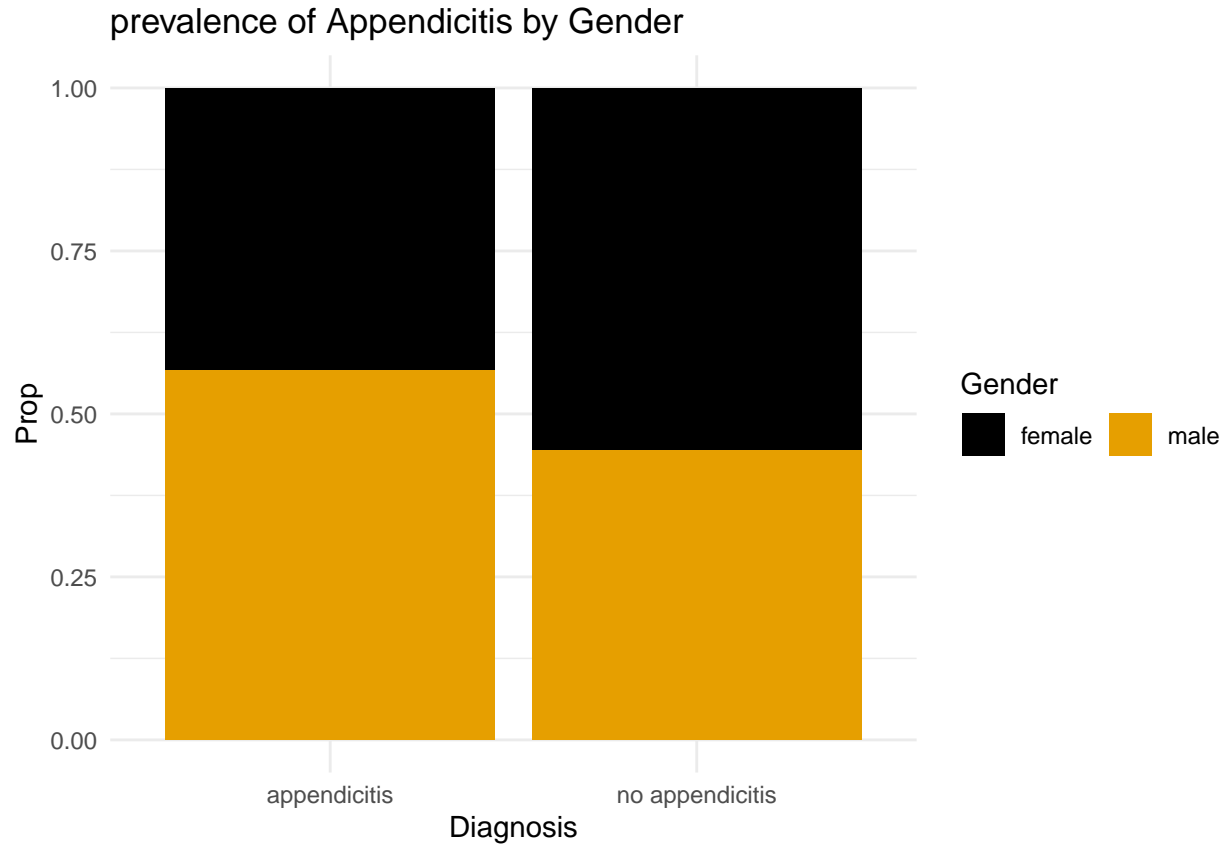


Figure 2: Prevalence of Appendicitis by Gender

Table 3: Prevalence of Appendicitis by Gender

Sex	Diagnosis	n	p
female	appendicitis	200	0.53
female	no appendicitis	176	0.47
male	appendicitis	262	0.65
male	no appendicitis	141	0.35

- Figure 2 shows that the prevalence in the appendicitis is more males than females which is consistent with existing finding, but it is not substantial.

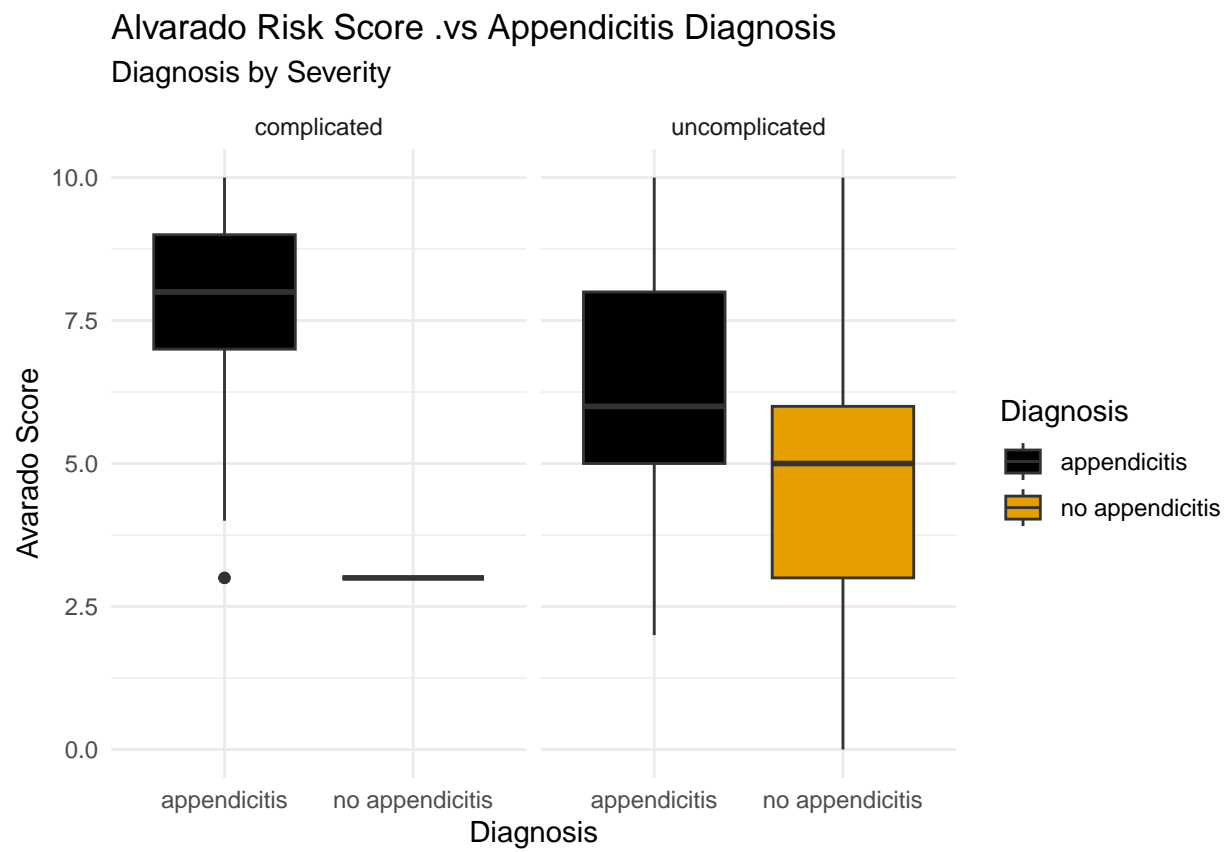


Figure 3: Alvarado Risk Score .vs Appendicitis Diagnosis

Table 4: Alvarado Risk Score .vs Appendicitis Diagnosis

Diagnosis	mean
appendicitis	6.669746
no appendicitis	4.831650

- Alvarado score is a system that have been developed to identify people who are likely to have appendicitis, like a score below 5 suggests against a diagnosis of appendicitis, whereas a score of 7 or more is predictive of acute appendicitis, but it is performance varies. Here added the severity diagnosis to see if the score differs also.

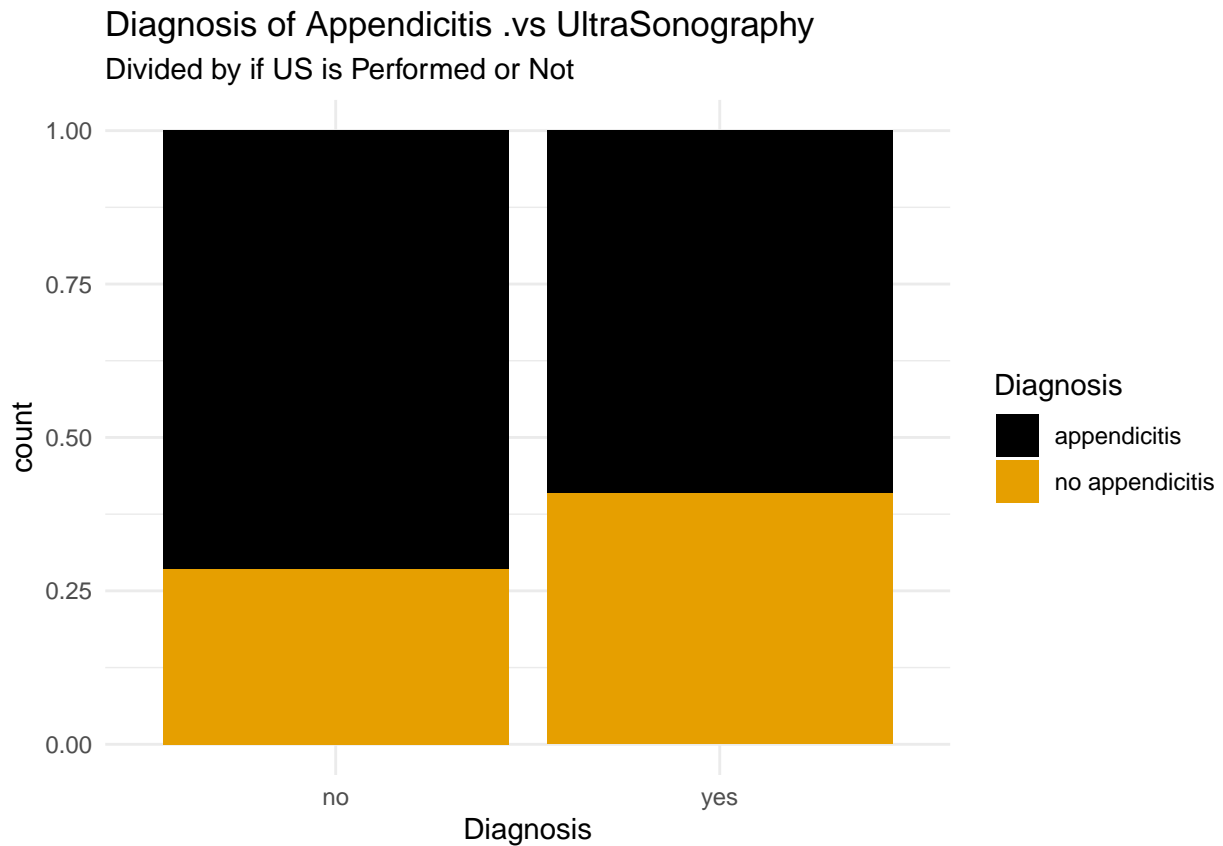


Figure 4: Diagnosis of Appendicitis .vs UltraSonography

- In cases where the diagnosis is unclear, other methods are preferred like medical imaging for example (CT, US), CT is more accurate but it is expensive and has some side effects, US may be preferred as the first imaging test in children and pregnant women because of the risks associated with radiation exposure from CT scans.

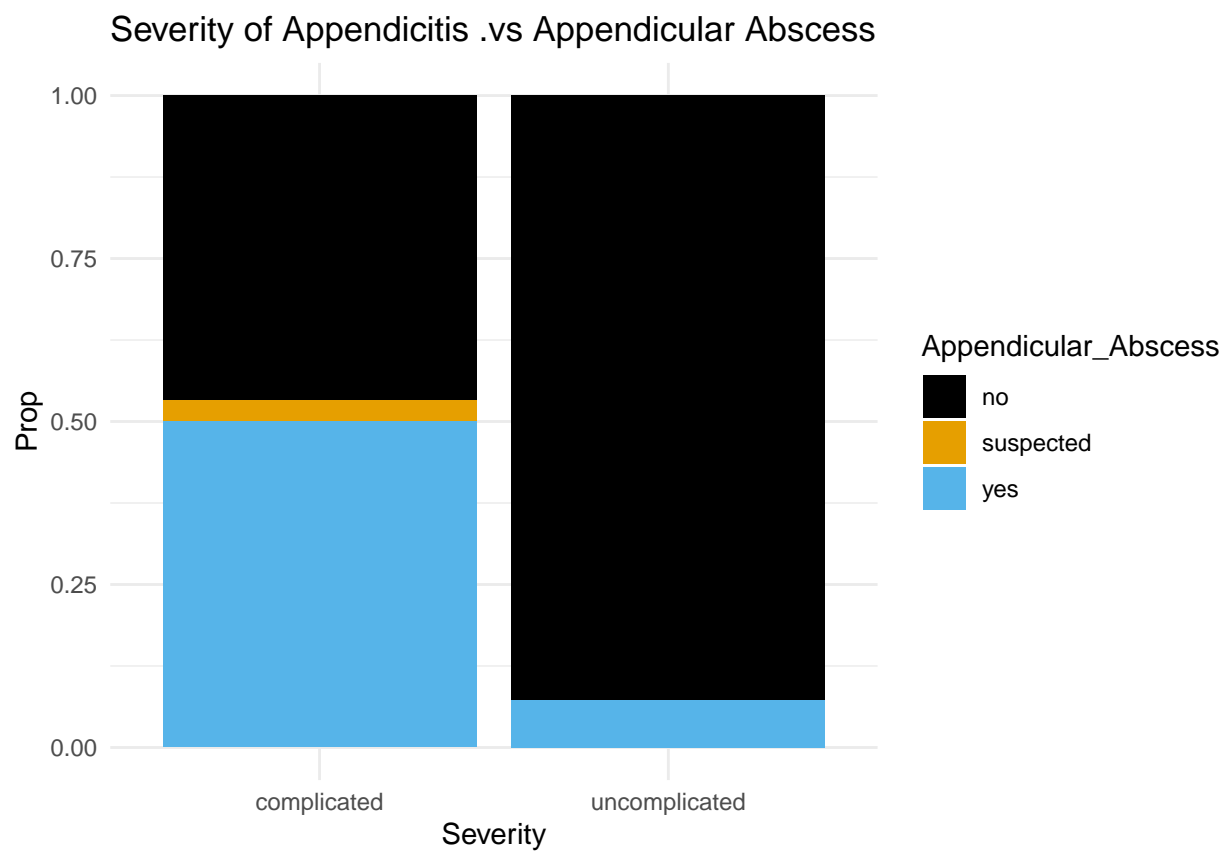


Figure 5: Severity of Appendicitis .vs Appendicular Abscess

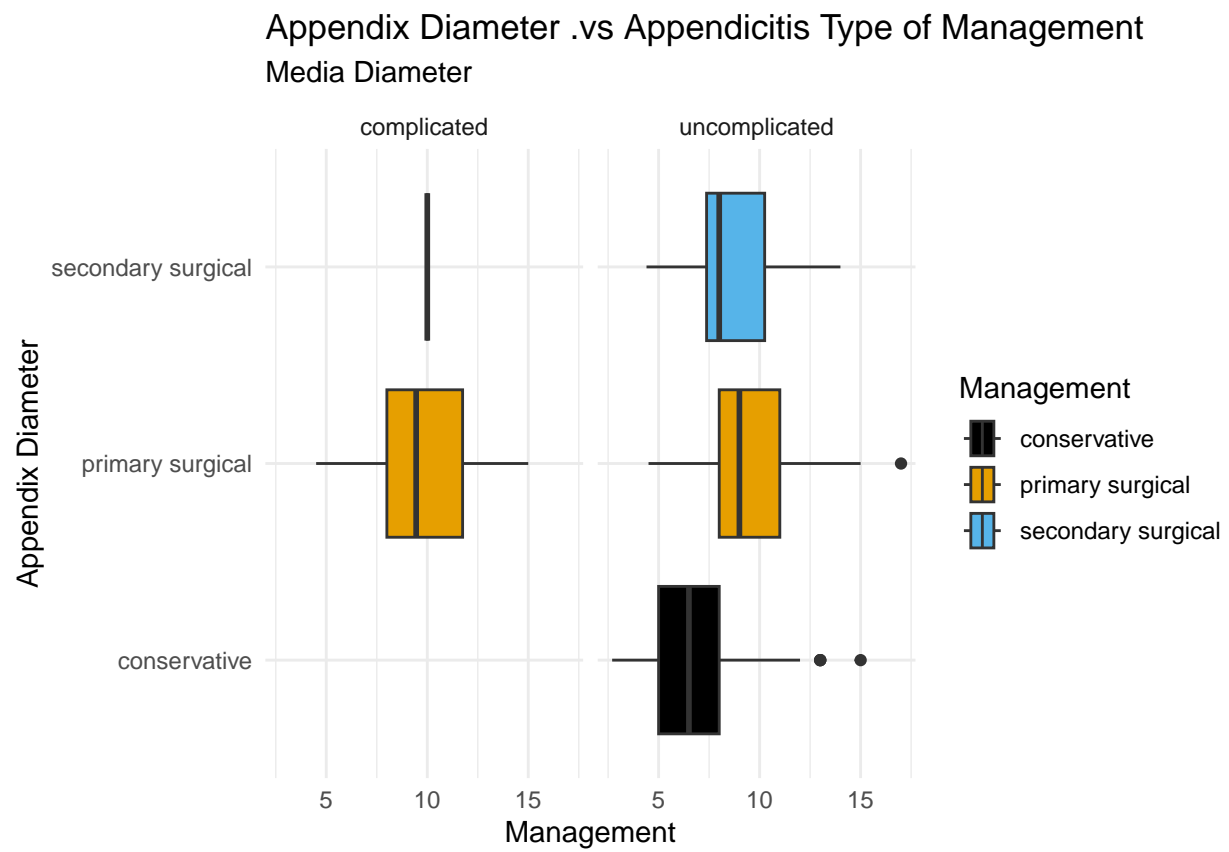


Figure 6: Appendix Diameter .vs Appendicitis Type of Management

Table 5: Mean of Appendix Diameter By Appendicitis Management

Management	mean
conservative	6.72
primary surgical	9.33
secondary surgical	8.80

Statistical Modeling

The Ultra-Sonography showed a difference in the proportion of patients diagnosed with Appendicitis, first let us see the discernibility (i.e significance) for that difference then quatify it.

Null ypothesis

There is no difference in the proportion between pateint's who diagnosed appendicitis when using US.

Alternative hypothesis

There is a difference in the proportion between pateint's who diagnosed appendicitis when using US.

p_value
0.518

- The p-value is .518, since the p-value is more than 0.05

Table 7: 95% Confidence interval for difference in appendicitis diagnosis whe ultrasonography is performed

lower_ci	upper_ci
-0.36	0.15

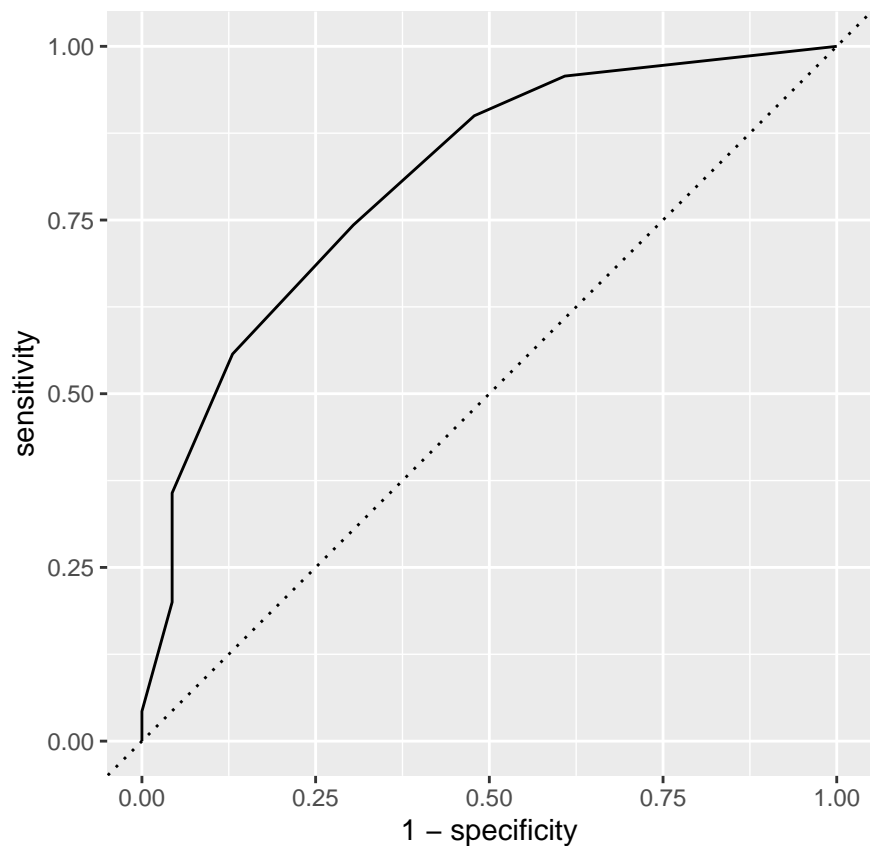
```
## Warning: Please be cautious in reporting a p-value of 0. This result is an approximation
## based on the number of 'reps' chosen in the 'generate()' step.
## i See 'get_p_value()' ('?infer::get_p_value()') for more information.
```

p_value
0

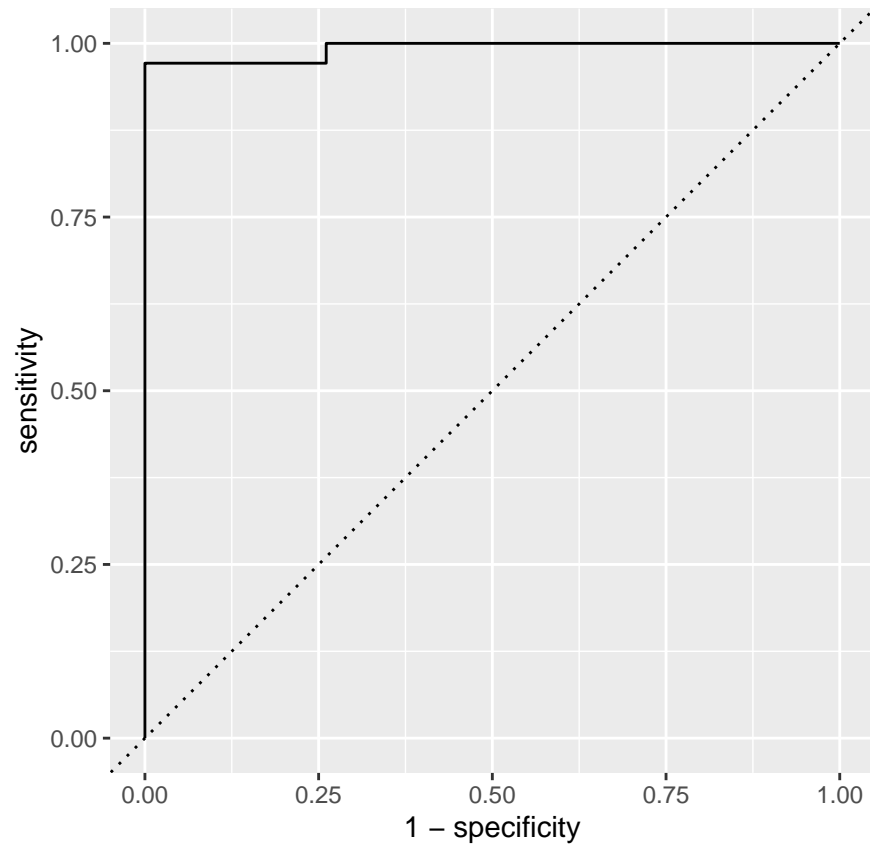
```
## # A tibble: 1 x 4
##   mean median min  max
##   <dbl> <dbl> <dbl> <dbl>
## 1     8     8   2.7   17
```

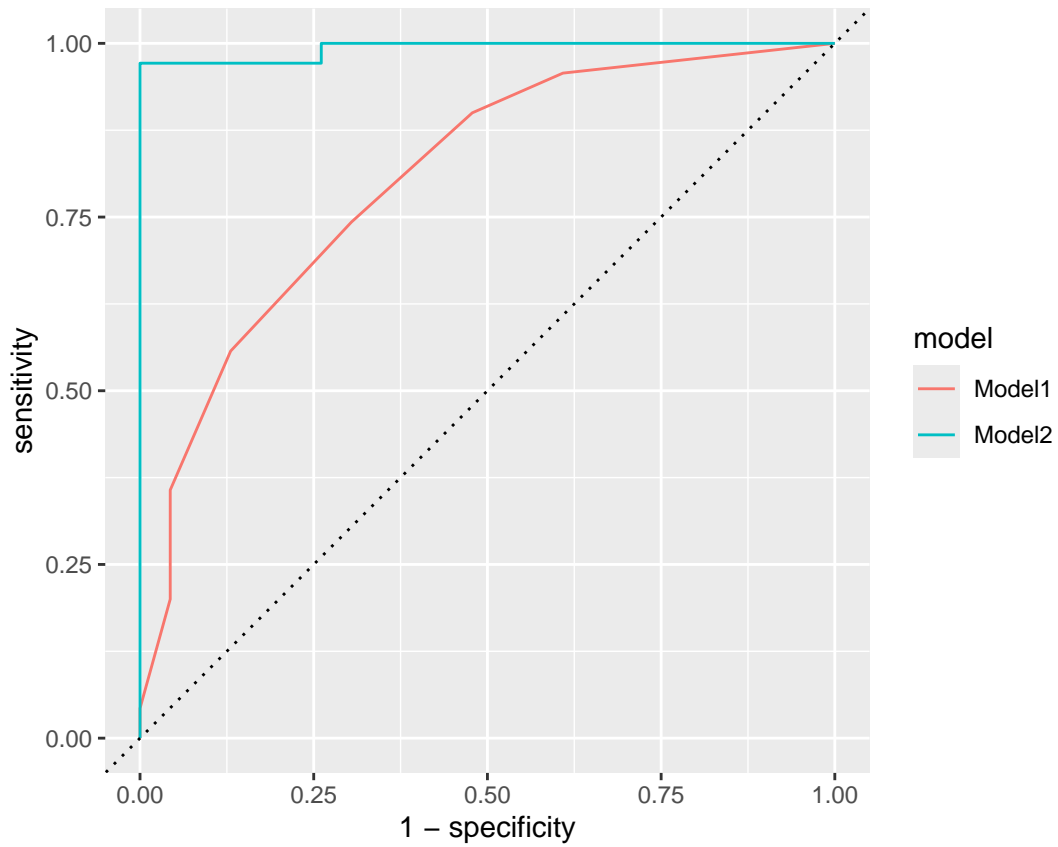

lower_ci	upper_ci
3.37	3.94

```
## # A tibble: 4 x 5
## # Groups:   Diagnosis [2]
##   .pred_class Diagnosis      n      p decision
##   <fct>         <fct>    <int> <dbl> <chr>
## 1 appendicitis appendicitis    67  0.96 True positive
## 2 no appendicitis appendicitis     3  0.04 False negative
## 3 appendicitis no appendicitis    14  0.61 <NA>
## 4 no appendicitis no appendicitis     9  0.39 True negative
```



```
## # A tibble: 3 x 5
## # Groups:   Diagnosis [2]
##   .pred_class Diagnosis      n      p decision
##   <fct>         <fct>    <int> <dbl> <chr>
## 1 appendicitis appendicitis    67  0.96 True positive
## 2 no appendicitis appendicitis     3  0.04 False negative
## 3 no appendicitis no appendicitis    23  1    True negative
```





```
## # A tibble: 1 x 3
##   .metric .estimator .estimate
##   <chr>   <chr>       <dbl>
## 1 roc_auc binary      0.805
```

```
## # A tibble: 1 x 3
##   .metric .estimator .estimate
##   <chr>   <chr>       <dbl>
## 1 roc_auc binary      0.993
```