# Exploration of the Safety of Droperidol Use in the ER

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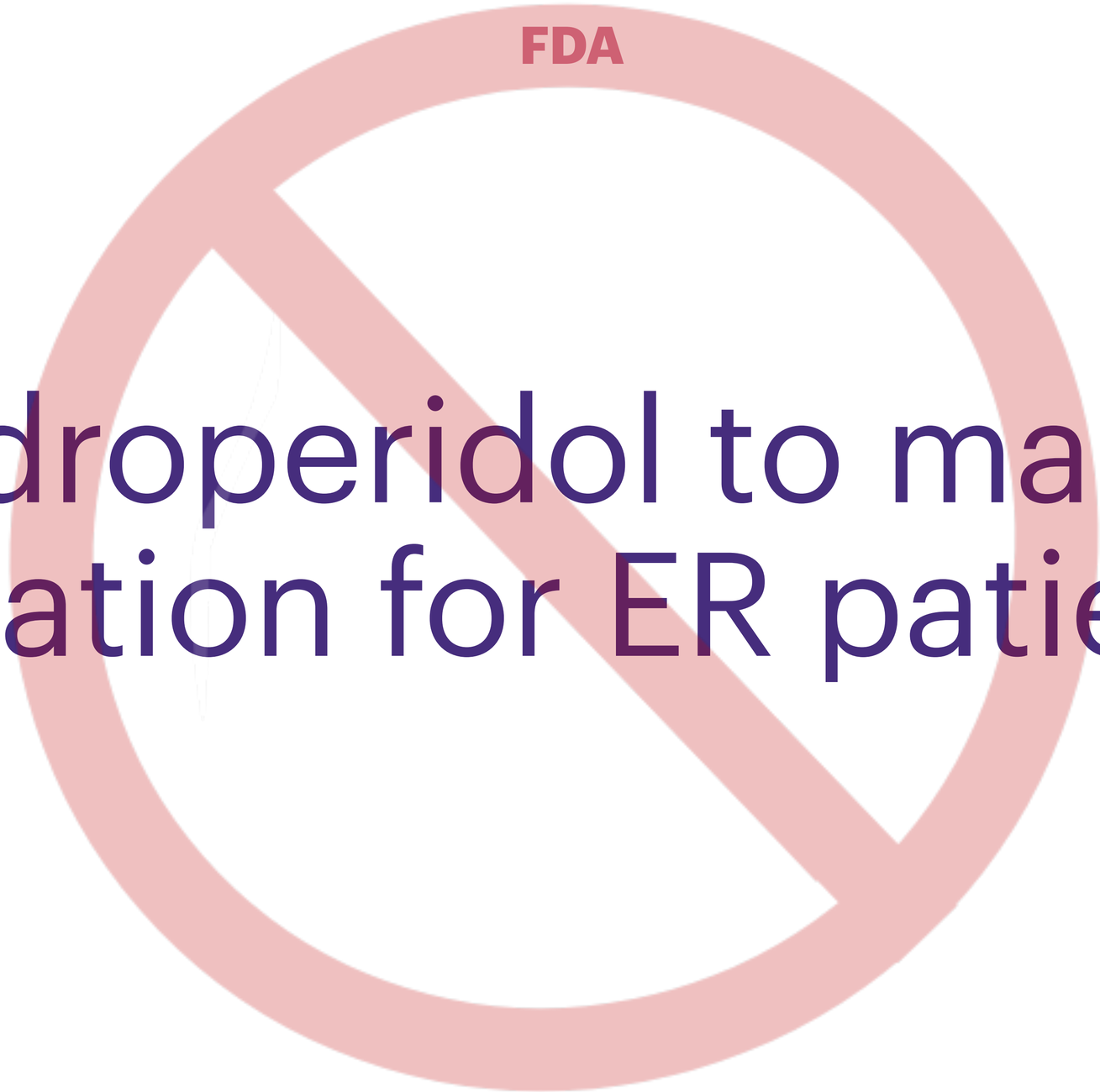



# Use droperidol to manage agitation for ER patients

# Tran's Hypothesis

droperidol is safe to use at the dosages administered in the ER

# Absolute Risk of Arrhythmia

$$AR = \frac{\text{\# of patients with an arrhythmia after receiving droperidol}}{\text{\# of patients that received droperidol}} \cdot 100$$

**Point estimate:**

$\widehat{AR} = 6.9\,\%$

**95% confidence interval:**

$(5.0\,\%, 8.9\%)$

About 7% of the patients that received droperidol in the ER had an arrhythmia

# What factors are associated with an *increased* risk of arrhythmia?

# Possible predictors of arrhythmia

## Variables measured before or at time of administering droperidol

Legal Sex

Age

Indication

EKG obtained before?

QTc (before)

Administered Dose Amount (mg)

# Possible predictors of arrhythmia

**Variables measured before or ~~at time~~ within 30 minutes of administering droperidol**

Legal Sex

Age

Indication

EKG obtained before?

QTc (before)

Administered Dose Amount (mg)

Total Dose (mg)

# Possible predictors of arrhythmia

**Variables measured before or ~~at time~~ within 30 minutes of administering droperidol**

Legal Sex

Age

Indication

EKG obtained before?

QTc (before)

**redundant** →

QTc (before)

Administered Dose Amount (mg)

Total Dose (mg)

# Possible predictors of arrhythmia

**Variables measured before or ~~at time~~ within 30 minutes of administering droperidol**

Legal Sex

Age

Indication

~~EKG obtained before?~~

QTc (before)

Administered Dose Amount (mg)

Total Dose (mg)

**Similar, but different** →

Total Dose (mg)

# Possible predictors of arrhythmia

**Variables measured before or ~~at time~~ within 30 minutes of administering droperidol**

Legal Sex

Age

Indication

~~EKG obtained before?~~

QTc (before)

~~Administered Dose Amount (mg)~~

Total Dose (mg)

# Logistic Regression

**Possible Predictors**

Legal Sex

Age

Indication

QTc (before)

Total Dose (mg)

# Logistic Regression

**Possible Predictors**

Legal Sex

Age

Indication

~~QTc (before)~~ ← 75.7% of measurements missing

Total Dose (mg)

# Logistic Regression

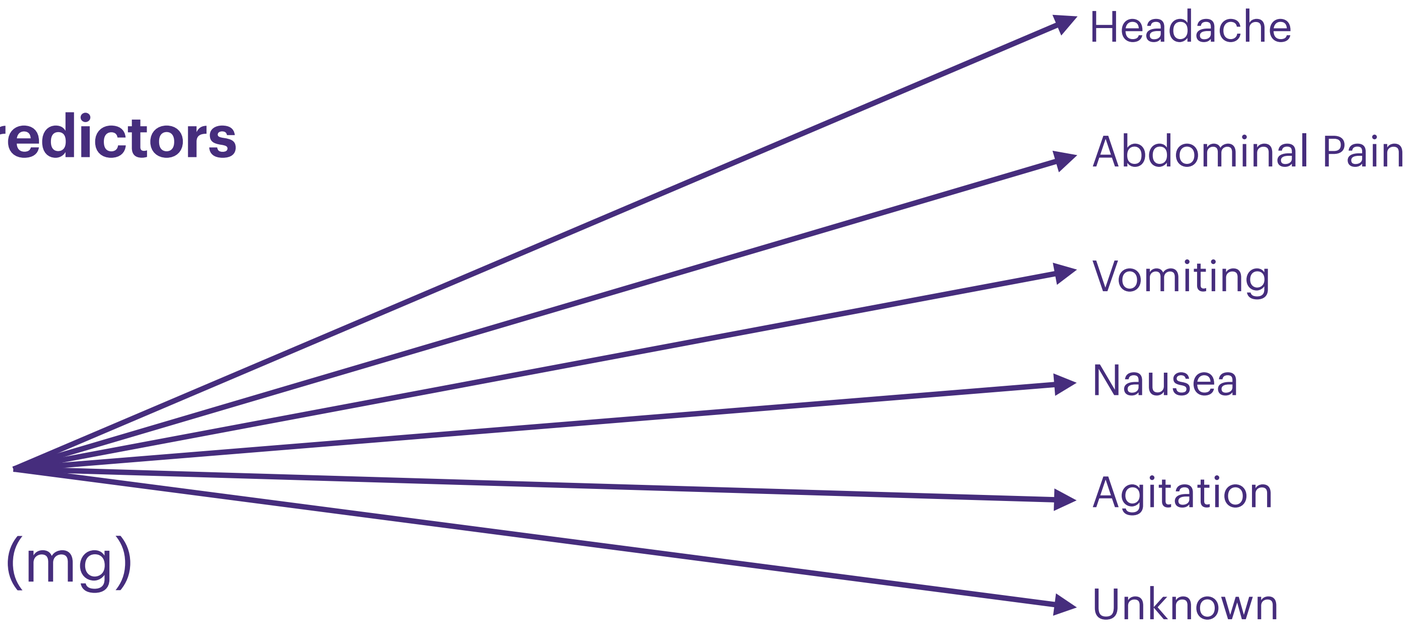
**Possible Predictors**

Legal Sex

Age

Indication

Total Dose (mg)



# Logistic Regression

## Correlation Matrix

| | Legal Sex | Age | Total Dose | QTc (before) | Abdominal pain | Nausea | Agitation | Vomiting | Unknown | Headache |
|---|---|---|---|---|---|---|---|---|---|---|
| Legal Sex | 1.00 | 0.07 | 0.09 | 0.14 | 0.01 | -0.07 | 0.20 | -0.08 | -0.06 | -0.19 |
| Age | 0.07 | 1.00 | -0.01 | 0.12 | 0.00 | -0.09 | 0.10 | -0.09 | 0.00 | -0.03 |
| Total Dose | 0.09 | -0.01 | 1.00 | 0.16 | -0.06 | -0.29 | 0.51 | -0.28 | -0.12 | -0.33 |
| QTc (before) | 0.14 | 0.12 | -0.16 | 1.00 | -0.10 | 0.03 | 0.03 | 0.03 | 0.09 | -0.10 |
| Abdominal pain | 0.01 | 0.00 | -0.06 | -0.10 | 1.00 | -0.04 | -0.14 | -0.07 | -0.02 | -0.05 |
| Nausea | -0.07 | -0.09 | -0.29 | 0.03 | -0.04 | 1.00 | -0.64 | 1.00 | -0.09 | -0.15 |
| Agitation | 0.20 | 0.10 | 0.51 | 0.03 | -0.14 | -0.64 | 1.00 | -0.64 | -0.19 | -0.51 |
| Vomiting | -0.08 | -0.09 | -0.28 | 0.03 | -0.07 | 1.00 | -0.64 | 1.00 | -0.09 | -0.15 |
| Unknown | -0.06 | 0.00 | -0.12 | 0.09 | -0.02 | -0.09 | -0.19 | -0.09 | 1.00 | -0.07 |
| Headache | -0.19 | -0.03 | -0.33 | -0.10 | -0.05 | -0.15 | -0.51 | -0.15 | -0.07 | 1.00 |

removed nausea

# Logistic Regression

**Possible Predictors**

Legal Sex

Age

Headache

Abdominal Pain

Vomiting

Agitation

Unknown

Total Dose (mg)

**warning**
glm.fit: fitted probabilities numerically 0 or 1 occurred

# Logistic Regression

**Possible Predictors**

Legal Sex

Age

Headache ← No arrhythmias

Abdominal Pain

Vomiting

Agitation

Unknown ← No arrhythmias

Total Dose (mg)

**warning**
glm.fit: fitted probabilities
numerically 0 or 1 occurred

# Logistic Regression

**Possible Predictors**

Legal Sex

Age

~~Headache~~

Abdominal Pain

Vomiting

Agitation

~~Unknown~~

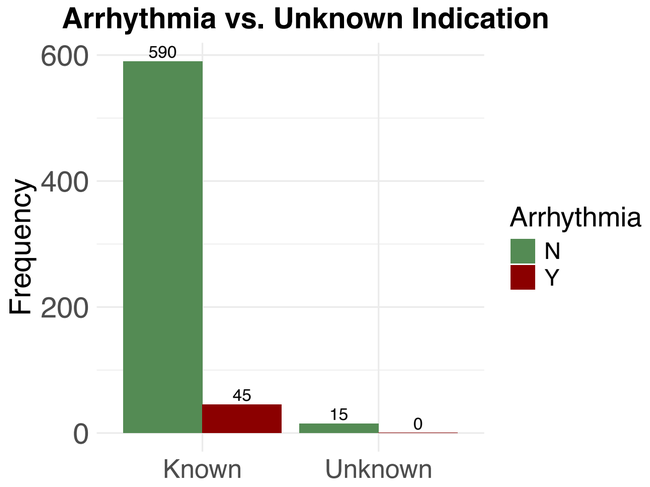
Total Dose (mg)

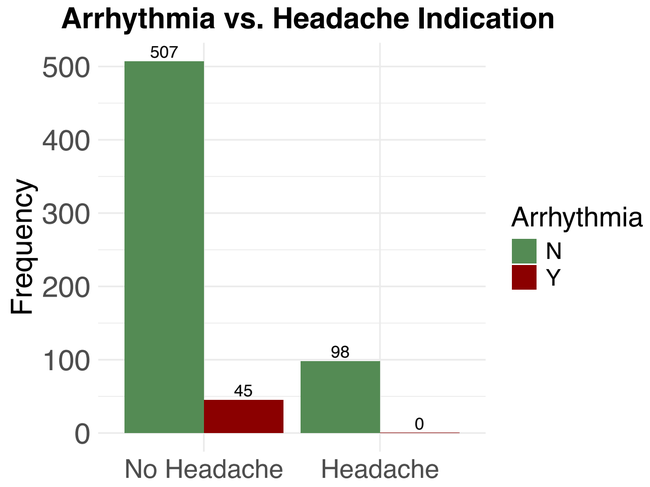
Agitation associated with
*increased* risk of arrhythmia

| | $\hat{\beta}$ | Std. Error | p-value |
|---|---|---|---|
| Intercept | -4.733 | 0.885 | $8.838 \times 10^{-8}$ |
| Sex (Male) | 0.104 | 0.344 | 0.762 |
| Sex (X) | -13.424 | 1333.927 | 0.992 |
| Age | 0.007 | .010 | 0.508 |
| Total Dose | 0.002 | .082 | 0.982 |
| Abdominal Pain | -12.195 | 799.084 | 0.989 |
| Agitation | 2.055 | 0.723 | 0.004 |
| Vomiting | 1.203 | 0.721 | 0.095 |

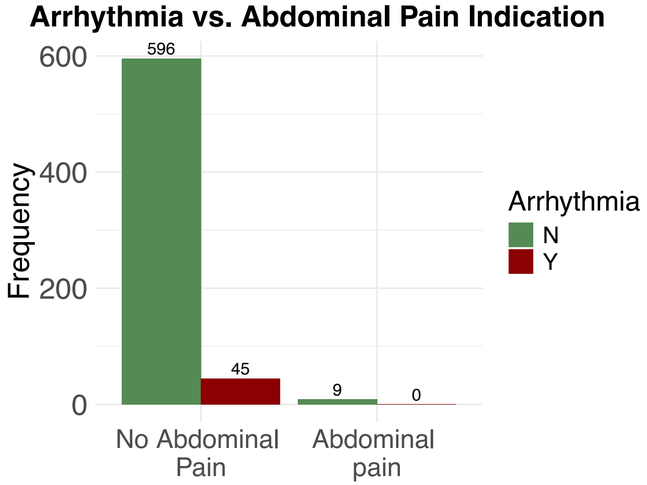
# Fisher's Exact Test

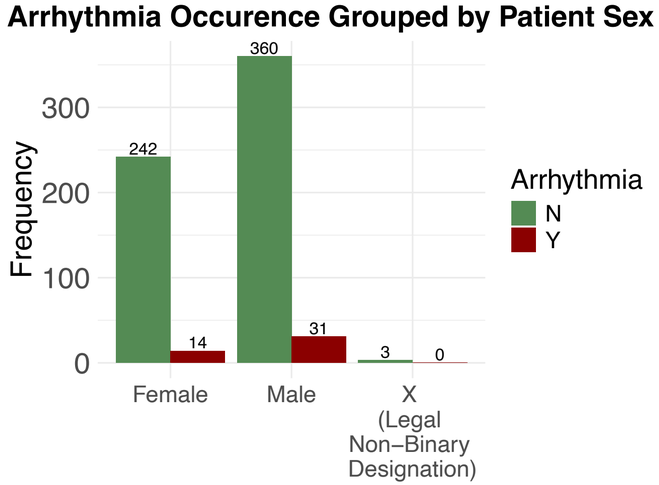
## Test of association for low frequencies




| Variable | Odds Ratio | 95% CI | p-value |
|---|---|---|---|
| Unknown | 0 | (0, 3.8) | 0.6154 |
| Headache | 0 | (0, 0.5) | 0.0008163 |
| Abdominal pain | 0 | (0, 6.9) | 1 |
| Sex (X) | 0 | (0, 33.0) | 1 |




Headache associated with *decreased* risk of arrhythmia

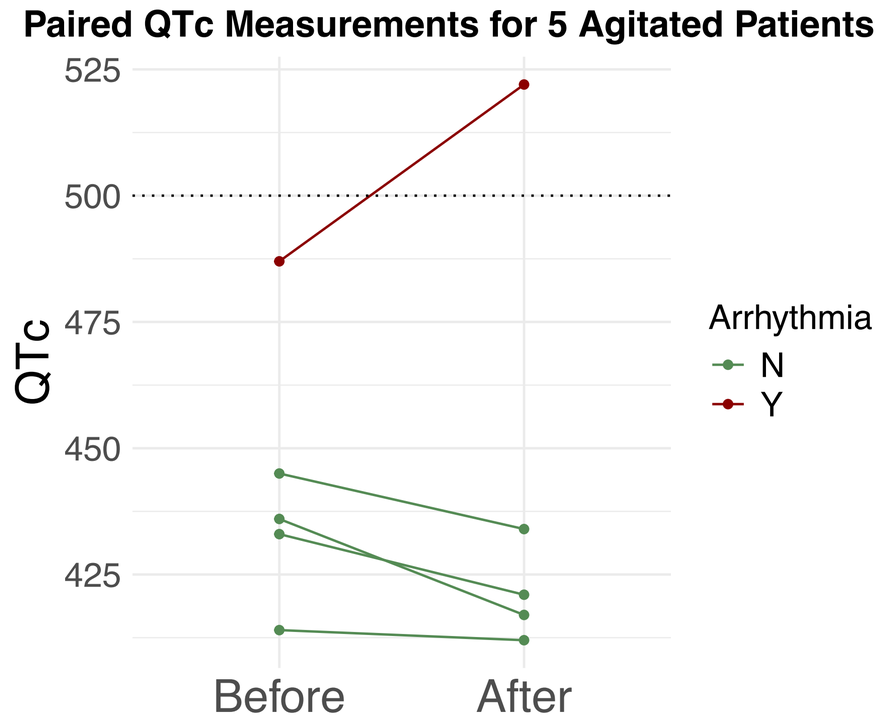
# Inference using QTc measurements

## among agitated patients

- Higher QTc ⟶ higher risk of arrhythmia

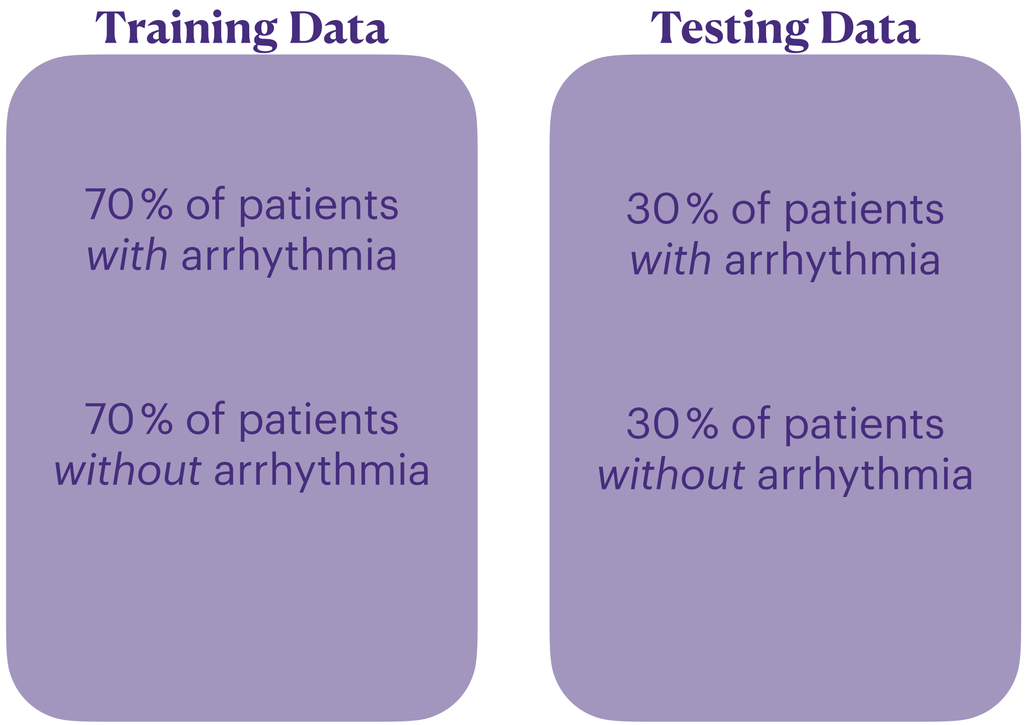
**Note:**

- Unfortunately, don’t have many paired observations for QTc(before) and QTc (after)
- EKG reading to measure QTc requires agitated patients to be calm, so QTc (before) measurements may be biased toward lower values



# Decision Trees

- **Imbalanced data:** 7% had an arrhythmia
- **Predictors:**
  - Legal Sex
  - Age
  - Headache
  - Abdominal Pain
  - Vomiting
  - Agitation
  - Unknown
  - Total Dose (mg)



# Decision Trees

## Without Balancing

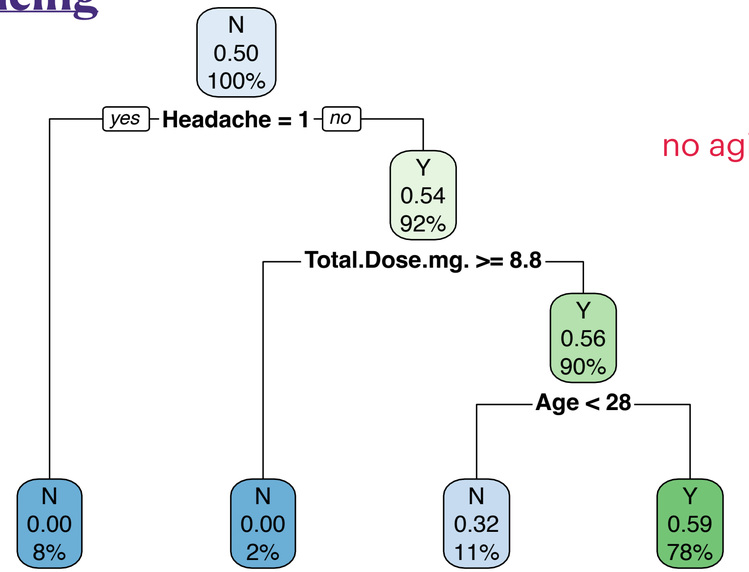

**total misclassification error:**
6.7%

**arrhythmia misclassification error:**
100%

**contingency table:**

| predictions | N | Y |
|---|---|---|
| N | 181 | 13 |
| Y | 0 | 0 |

## With Balancing




no agitation

**total misclassification error:**
64.4%

**arrhythmia misclassification error:**
23.1%

**contingency table:**

| predictions | N | Y |
|---|---|---|
| N | 66 | 3 |
| Y | 115 | 10 |

# Conclusion

- Agitation associated with *increased* risk of arrhythmia when administered droperidol
- Headache associated with *decreased* risk of arrhythmia when administered droperidol

## Next Steps

- For now, perhaps limit use of droperidol for agitated patients
- Repeat QTc inference w/ paired data
  - Obtain EKG measurements, *both* before and after, administering droperidol to agitated patients to isolate effect of droperidol (probably impossible)
- Collect similar data for patients in the ER that do not receive droperidol to compare arrhythmia occurrence with and without droperidol use