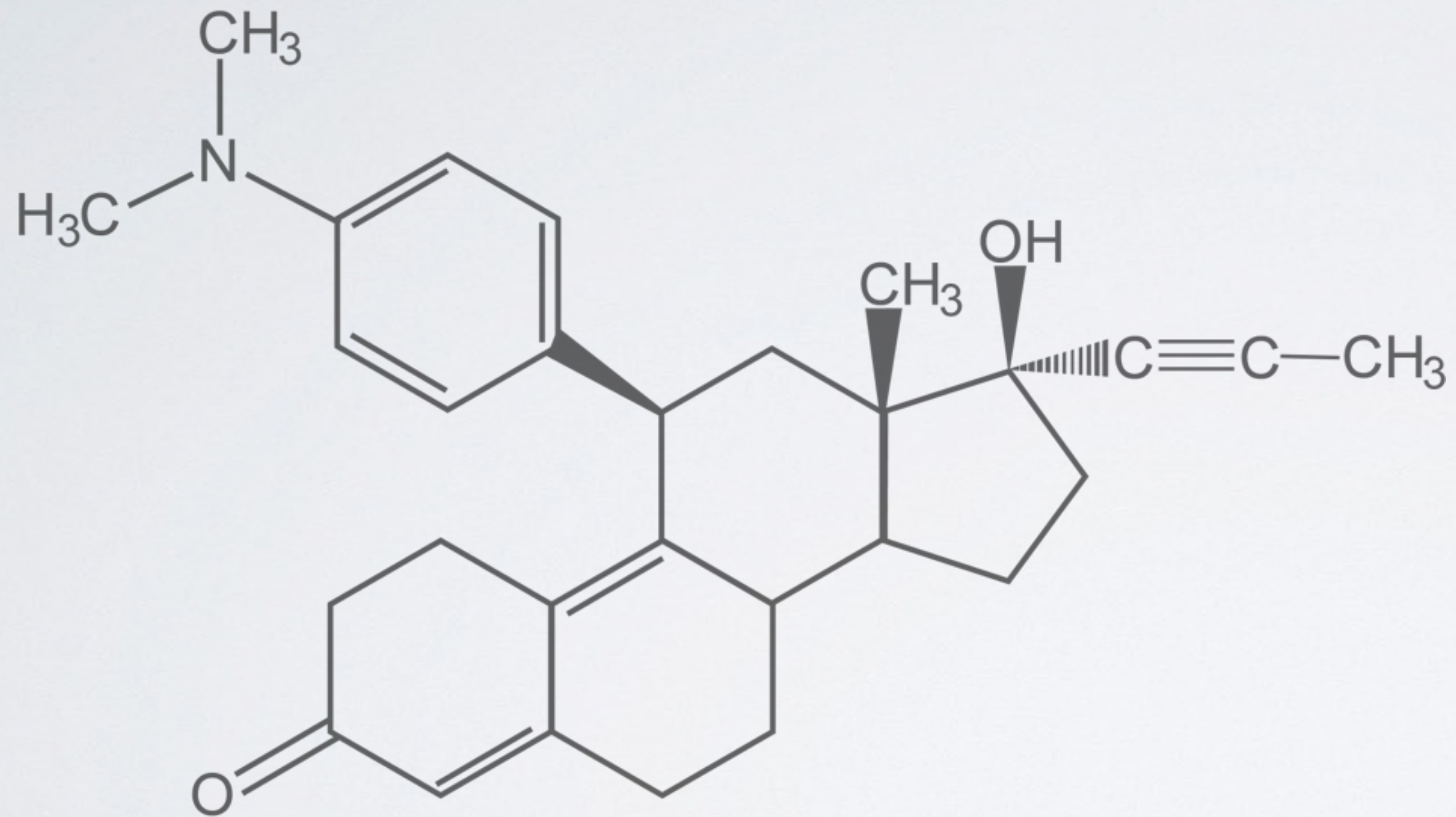


# inference on a binomial proportion

RU-486 morning-after contraceptive





## clinical trial details

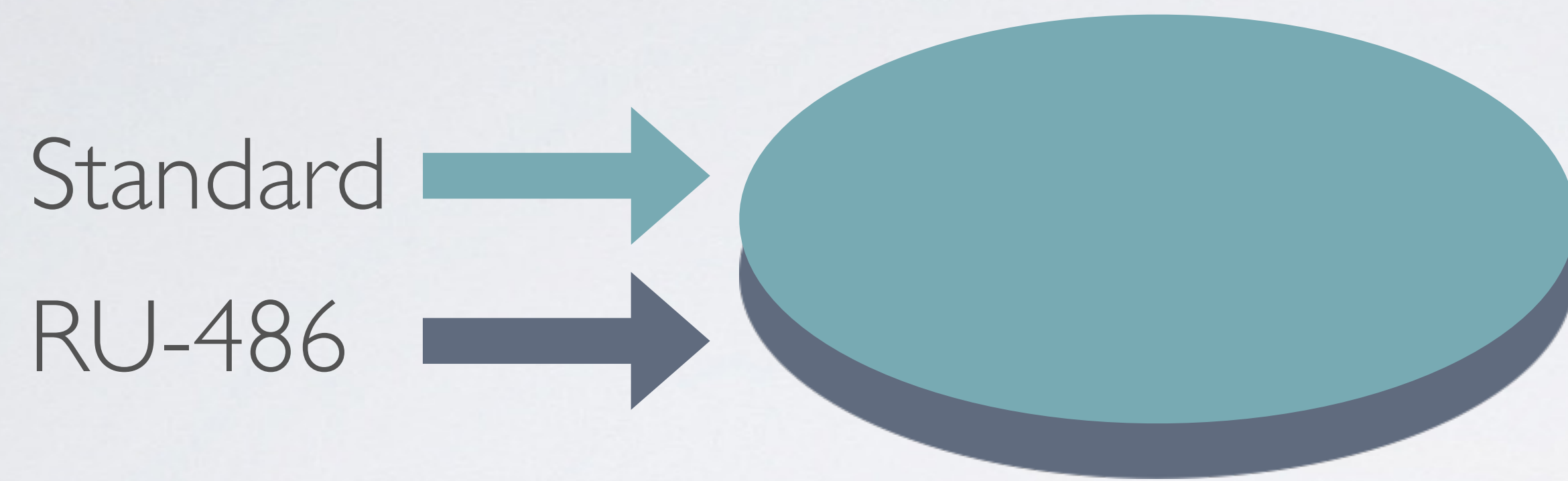
- ▶ 800 women
- ▶ sexual intercourse in previous 72 hours
- ▶ randomly assigned

**RU-486 treatment**

0 pregnancies

**standard treatment**

4 pregnancies





frequentist approach

$$H_o : p \geq 0.5 \quad \text{vs} \quad H_A : p < 0.5$$

$$\text{P-value} = 0.5^4 = 0.0625 > 0.05$$

do not reject null  
hypothesis

# Bayesian approach

**uniform distribution**      **posterior probability**

$\text{beta}(1, 1)$

$\text{beta}(1 + 0, 1 + 4)$



# Bayesian mean

the mean of a beta ( $\alpha, \beta$ ) distribution

$$\begin{array}{c} | \\ \alpha / (\alpha + \beta) \end{array}$$

$$p = 1/6$$

# Bayesian standard deviation

the standard deviation of a beta ( $\alpha, \beta$ ) distribution

before data:  $p = 0.71$

after data:  $p = 0.13$



0.96875

$p < 0.5$

$p > 0.5$

## summary

- ▶ how to build a **statistical model**
- ▶ frequentist vs. Bayesian approaches lead to **different** conclusions
- ▶ Bayesian approaches learn from **data**
- ▶ yesterday's posterior is **today's prior**