Chapter 8: The Two-Sample *t*-test (2): The Dreaded P-value

TXCL7565/PHSC7565

What This Chapter Covers

- Measuring how significant a result is

- P-values

- Two ways to define significance

- Obtaining the p-value

MEASURING HOW SIGNIFICANT A RESULT IS

With confidence intervals, we classified results as either 'significant' or 'non-significant'.

But a dichotomous choice isn't always satisfying…

Difference in theophylline clearance (ml.min^{-1}.kg^{-1})

No change
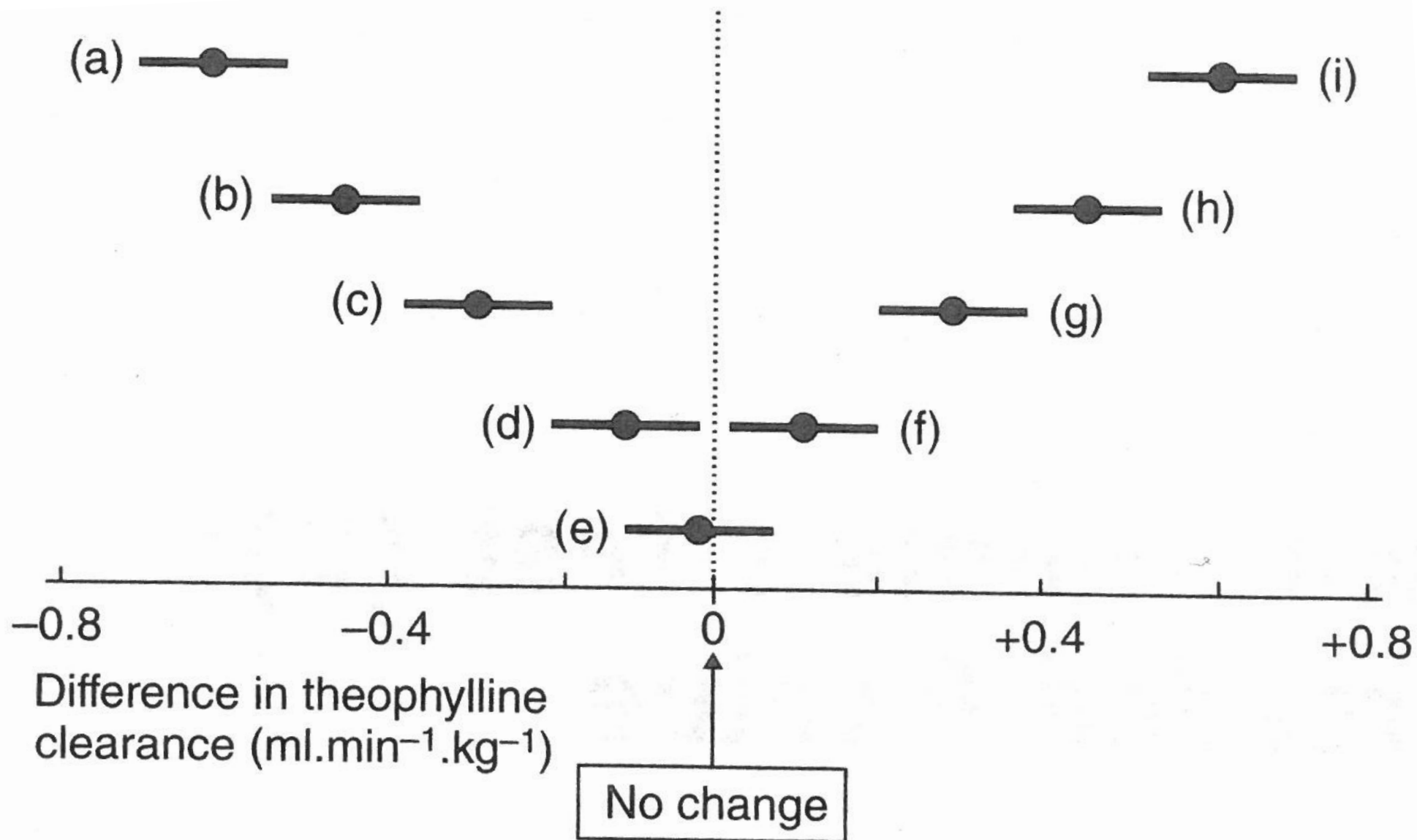
P-VALUE

p-value

- **Definition**: The p-value is the probability that with a treatment that has no real effect, we would observe an effect (positive or negative) as extreme as (or more extreme than) the one actually observed.

- P-value is a quantitative measure of 'how significant' or 'how confident' you are that there is no effect

- smaller p-value = stronger evidence against 'no effect'

p-value and type I error

p-value = probability of making a *type I error* when there is no true effect

TWO WAYS TO DEFINE SIGNIFICANCE?

p-value vs. confidence interval

Two ways to define significance:

1. If the 95% confidence interval for the size of the experimental effect excludes zero, the result is significant.

2. If the p-value is less than 0.05, the result is significant

As long as the threshold for significance, i.e., **α**, is equal to 1 - the level of confidence, the p-value and the confidence interval will come to the same conclusion on significance.

OBTAINING THE P-VALUE

From GraphPad Prism

	Unpaired t test	
7	Unpaired t test	
8	P value	0.0005
9	P value summary	***
10	Significantly different (P < 0.05)?	Yes
11	One- or two-tailed P value?	Two-tailed
12	t, df	t=3.909 df=28
13		

very low p-values

- Very low p-values are often suspect.

- NEVER report a p-value of 0

  ★ There is always some probability that you could get the result by chance.

- Instead report 'p-value < 0.01'

P-VALUES
OR
CONFIDENCE INTERVALS?

- A p-value simply indicates the strength of the evidence against a null hypothesis.

- A confidence interval indicates both the strength of the evidence against a null hypothesis and size of the experimental response

- BUT, reporting the p-value is more common in some fields

- AND for some statistical tests, a confidence interval isn't relevant

What did we learn?

- P-values are a quantitative measure of how confident we are that there is no real treatment effect

- P-values and confidence intervals will come to the same conclusion on significance

- NEVER report a p-value = 0

- Confidence intervals are often more informative than p-values