HW 2 DUE SUN 28 OCT

16th October 2018

Experimental Design continued...

Outcome ($\overline{Y}$): cortex weight

treatment ($\overline{X}$): (T) Enriched ← TREATMENT

(C) Deprived ← CONTROL

Subjects: Rats (male)

BAD design: No control, ← nothing to compare with

"Get a bunch of rats ..."

| Enriched | Deprived |
|---|---|
| $y_1$ | $x_1$ |
| $y_2$ | $x_2$ |
| $y_3$ | $x_3$ |
| $y_4$ | $x_4$ |
| $y_5$ | $x_5$ |

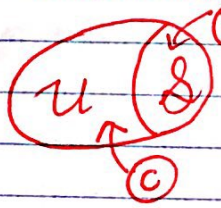
n

Factual V/S Counterfactual

↑ control

→ (T and C)

GOAL: TO compare 2 groups for a certain variable, try to make both groups as similar as possible in all relevant ways except for the variable of interest. → GOOD DESIGN




[assign rats to treatment and control @ random.]

DESIGN 1: 120 pure bred strain rats → Assigned Randomly → 60 (T), 60 (C)

Genetically Pure Strain → Pick @ Random → n = 120 male rats → 60 (T), 60 At Random, 60 (C)

(COMPLETELY RANDOMISED DESIGN (CRD))

FLOW CHART

data set

| cort. weight (T) | cortex weight (C) |
|---|---|
| n = 60 | n = 60 |
| mean 683 mg | mean 647 mg |
| SD | SD |

Q1: Is 683 mg different from 647 mg by an amount that's large in practical (biological) terms?
↳ PRACTICALLY SIGNIFICANT?

(A) First 683 mg is 36 mg heavier than 647 mg — ABSOLUTE COMPARISON

(B) Second $\frac{683\,mg - 647\,mg}{647\,mg} = \frac{36}{647} = 5.6\%$ $\left[\frac{\bar{Y}_1 - \bar{Y}_2}{\bar{Y}_2}\right]$

(1) "Mean cortex weight in (T) was 5.6% larger than that in (C) in cortex weight"

However, $\left[\frac{\bar{Y}_2 - \bar{Y}_1}{\bar{Y}_1}\right]$ isn't the same

(2) "Mean cortex weight in (C) was 5.3% smaller than that in (T) cortex weight"

*Gender is a PCF here, so is genetics

# BOTH STATEMENTS ARE CORRECT

Heuristic Rule: Relative differences of 5% or more are often large in practical terms
Relative differences of <5% can also be practising if they accumulate over time.

eg: Change of 1% per year → (10 yrs) Change of 10%

Q: In design I, is it fair to conclude that the diff. (5.6%) was caused by (T) v/s (C) environment?

Q. Is data I unbiased?

Def. A data gathering method is unbiased if when repeated hypothetically, the results averaged you get the right answer.

Def. Bias: A systematic tendency to get the wrong answer

Random = UNBIASED.

Def. The design is valid for causal conclusions if unbiased

(COMPLETELY RANDOMISED DESIGN) → Randomised controled trial (RCT)
↑ medicine.

$Z_1$: Potentially confounding factor (PCF) → cause bias

Def. 2 variables U and V are associated if when one goes up the other tends to go up or down on average
↑ positive association
↑ negative association

$Z_1$ is a PCF if: • It's plausible that $Z_1, Y$ are associated and $Z_1$ and $X$ are associated

→ HOW TO DEFEAT BIAS (DUE TO PCF) ?

2 WAYS

① at design time
- (A) (Simple but less accurate): Randomise to (T) and (C)
- (B) (more complicated but more accurate): HOLD IT CONSTANT

② at analysis time

DESIGN 2 (T) (C)

MATCHED PAIRS DESIGN ← special case of Randomised block (size 2)

| | $Y_1$ | $X_1$ |
|---|---|---|
| ① | | |

one row, pairs of brothers from same litter

n=60

60 liters chosen like @ random way → 2 brothers chosen → ① - T, ② - C } At Random

(3)

| block | Enriched | Normal | deprived |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| ⋮ | | | |

← each row is one litter with 3 brothers

- Placebo Effect: People sometimes respond to the idea of treatment rather than treatment itself.
  - → inert substance, looks just like the treatment.
  - (T) Blue Pill w/ active ing.
  - (C) " " w/o active ing (inert)

Desirable: Subjects don't know which group they're in

Blinding subjects to (T)/(C) status.

+ Blinding experimenters to (T)/(C) status of subjects. } DOUBLE BLIND.

* another design (#3) Repeated measure design (longitudinal)
  - ↗ Gives paired data
  - Same person w/ and w/o treatment pill

HOLDS PCF CONSTANT, ALL OF THEM!!

CROSS SECTIONAL: Cheaper + Easier.