STA305/1004 - Review Class

February 27, 2017

Today's class

- Review for midterm test

Midterm Test Information

Date: Wednesday, March 1

Time: The test will begin at approximately 11:10. The time allowed to complete the test will be 90 minutes.

Location:

- If your last name begins with a letter between A-M then you will write in AH400 (our classroom).
- If your last name begins with a letter between N-Z then you will write in EX310.

Test Preview:

Available at 1:00PM today on Portal.

In an observational Study the propensity Score can often be estimated

$$\text{prop-score} = P(T=1 \mid X)$$

Three ways to use estimated propensity Score to estimate treatment effect.

(1) Matching.

Find one Subject not treated and another Subject untreated with approx. the Same estimated propensity Score.

(2) Stratification based on PS.

→ Stratify based on PS quintiles.

(3) Direct regression adjustment.

→ include the PS in a regression model with the treatment indicator.

If T is the treatment indicator, Y is the outcome, and PS is the observed prop. Score.

$$Y = \beta_0 + \beta_1 T + \beta_2 PS + \varepsilon.$$

$\hat{\beta}_1$ – est. of treatment effect.

2016 MT

3 (a)

Method	Ave Trt. effect
Matched	2.93
Strat.	3.26
Reg.	3.40
Unadj	2.54

Reduce bias using PS methods?

Yes.

Q1

Consider a randomized study of two medical treatments A and B. Three subjects are randomized to treatment A and three subjects are randomized to treatment B. The response measured is mortality, y, after 6-weeks on treatment. Primary question: is there a difference in average mortality between the two treatments?

The data are below:

Subject	y	Treatment
1	5.56	A
5	14.73	A
4	7.13	A
6	8.32	B
3	4.01	B
2	10.91	B

trt. is randomized to subjects ∴ randomized experiment.

$\binom{6}{3} = 20$ possible randomizations.

3 red Card + 3 blacks Shuffle -

$T \perp y^0, y^1 \mid X$

1. Is the treatment assignment ignorable? Yes. ∴ treatment is independent of potential outcomes
2. How could subjects be randomized to treatment?

flip a ~~coin~~ AAAAAA

Q1

```
y <- c(yA,yB);observed <- mean(yA)-mean(yB);observed #obs mean diff
```

```
[1] 1.393333
```

```
index <- combn(1:6,3); res<-numeric(20)
for(i in 1:20){res[i] <- mean(y[index[,i]])-mean(y[-index[,i]])}
round(res,2)
```

```
 [1]  1.39  2.19 -0.69  3.91 -2.88 -5.75 -1.15 -4.96 -0.36 -3.23  3.23
[12]  0.36  4.96  1.15  5.75  2.88 -3.91  0.69 -2.19 -1.39
```

Randomization distn.

```
mean(res)
```

```
[1] 0
```

```
round(res-mean(res),2)
```

$t_i - \bar{t}$

```
 [1]  1.39  2.19 -0.69  3.91 -2.88 -5.75 -1.15 -4.96 -0.36 -3.23  3.23
[12]  0.36  4.96  1.15  5.75  2.88 -3.91  0.69 -2.19 -1.39
```

```
round(observed-mean(res),2)
```

$t^* - \bar{t}$

```
[1] 1.39
```

Q1

$H_0: \mu_A = \mu_B$

$H_1: \mu_A \neq \mu_B$

$$\sum_{i=1}^{\binom{6}{3}} I\left(|t_i - \bar{t}| \geq (t^* - \bar{t})\right) \Big/ \binom{6}{3}$$

t_i = i^{th} diff., $\bar{t}$ = mean of rand. dist.

3. Calculate the randomization P-value? t^* = observed mean diff.
4. Does the treatment *cause* a change in average mortality?

$= 14/20 = 0.7$

No evidence to reject H_0 ∴ no evidence that treatment causes change in mortality.

In a randomized study Causal conclusions are usually valid.

Q2

probability of rejecting H_0 when H_1 is true.

1. What is statistical power?
2. Suppose that a study is designed to test $H_0 : \mu = 0$ vs. $H_1 : \mu < 0$. The study is conducted with $n = 10, \sigma = 1$ using $\alpha = 0.05$. The data is analyzed: $\bar{x} = -0.36$, P-value $= 0.13$. Is the reason that the study is not significant due to low power? Maybe, but it could also be ~~a- Calculate power assume $\mu_1 = -0.36$~~ one reason for not rejecting is that H_1 is false.