

Discussion  
Section  
week of  
21-25 Oct 19

pp. R-29 # 4(9)  
-30

STAT 7  
21 Oct 19

experimental design: ①

1 row for each  
person with  
spinal puncture

1 = complete & permanent relief  
0 = not so

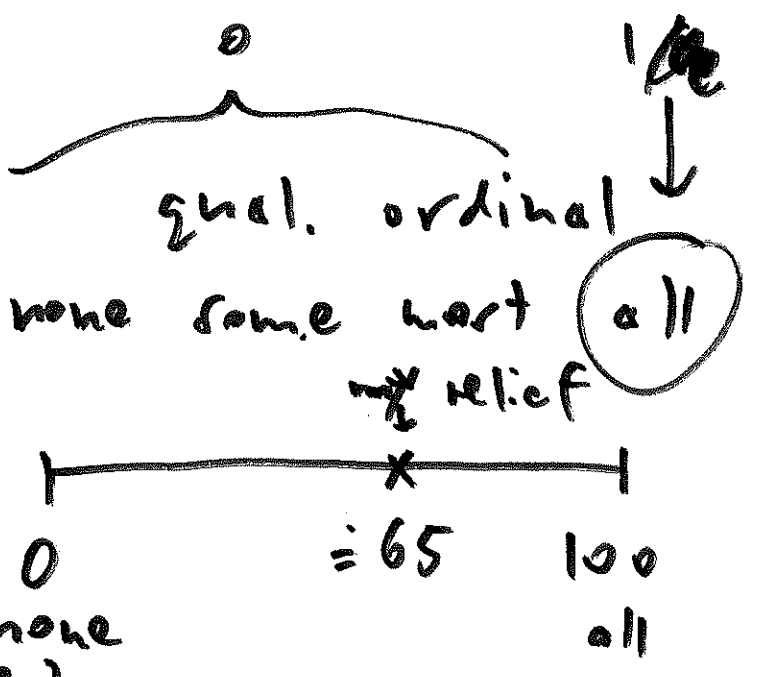
0	1
⋮	⋮
0	0
⋮	⋮
1	1
0	1

conv. relief: ②  
ach. relief: ③  
quant. dich.  $h=31$

relief: response  
or outcome  
variable

mean 0%  $\frac{30}{31} \approx 97\%$   
not separate  $\oplus, \otimes$  groups  
excellent

a better outcome:  
how much relief  
each person got



quant. cont. ratio  $\rightarrow$  0 none  
(most informative)

This is a repeated-measures design (class 2)  
in the)

causal effect question

Q: did acupuncture cause the diff. between 97% & 0% relief rates!

def.

if when  $X$  goes up,  $Y$  tends to go up or down on average  $\leftrightarrow X, Y$  are associated

(there is an association between

$X$  and  $Y$ )

$Y$  (outcome) (1: relief / 0: not)

$X$  (supposedly causal factor) (1: acn. / 0: control) (treatment)

Q:  $X, Y$  associated?

A: Yes

1/ just because  $X$  &  $Y$  associated, <sup>(3)</sup>  
can't conclude that  $X$  caused  $Y$   
or other way around

association  $\neq$  causation

$\leq$  ← weaker than or  
equal to

Q: If you tried to use (97% - 0%)  
as your prediction of how  
another acupuncture study (like  
Dr. Lo's) would turn out, is  
likely to be  
97% about right, or too high,  
or too low?

knows the  
of science

replication of <sup>(4)</sup>  
results

this demonstrates generalizability

devil's  
advocate

① population  
all headache  
patients from  
spinal  
puncture

how  
related

Dr. Lo  
has  
31  
patients

not at  
random

② placebo  
effect

⊕ needles in right places

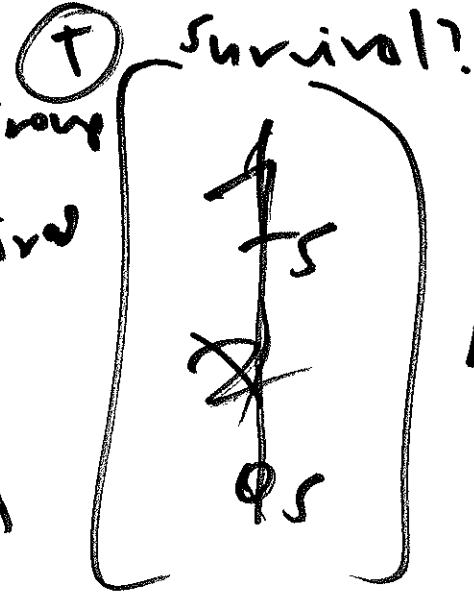
⊖

no-  
effect

← according to  
Chinese medical  
theory

4(b)

1 = Survival  
2, 3  
7, 8  
0 = died



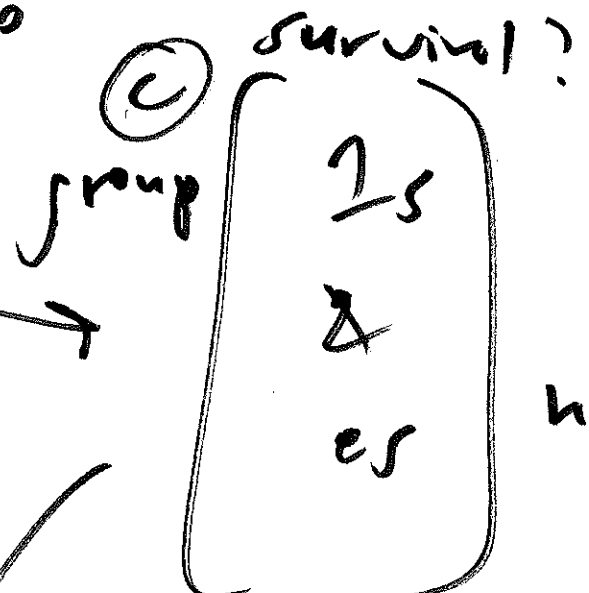
n = 100

mean 98%

Dr. Allgot's data  
1 row for each of patients  
h = 100

not PET

obs. study:  
PCFs are energy



n = 300

mean 68%

other data

R - 30  
4 (9)

	relief!	relief (who)
0	0	1
⋮	⋮	⋮
0	0	0
⋮	⋮	⋮
0	0	⋮

acc. info. (T) 1 row for each patient  
n = 31  
(suppt) (who)

1-5  
acc. treatments

mean 0%  $\frac{30}{31} = 97\%$

possible ways she measured her outcome var.

(response)  
Y = outcome variable  
X = treatment (supposedly causal factor)

① frequency of (severe) headaches  
quant. | disc. | ratio

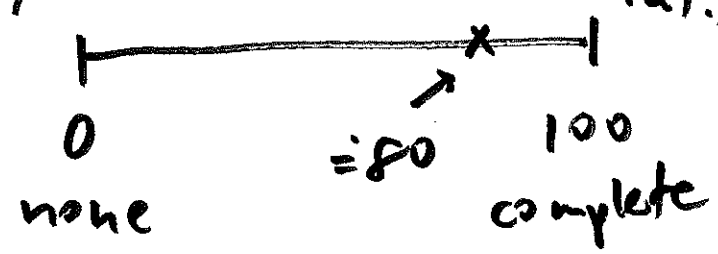
② intensity of headaches

least informative  
③ complete relief  
yes | 1  
no | 0  
quant. | disc.

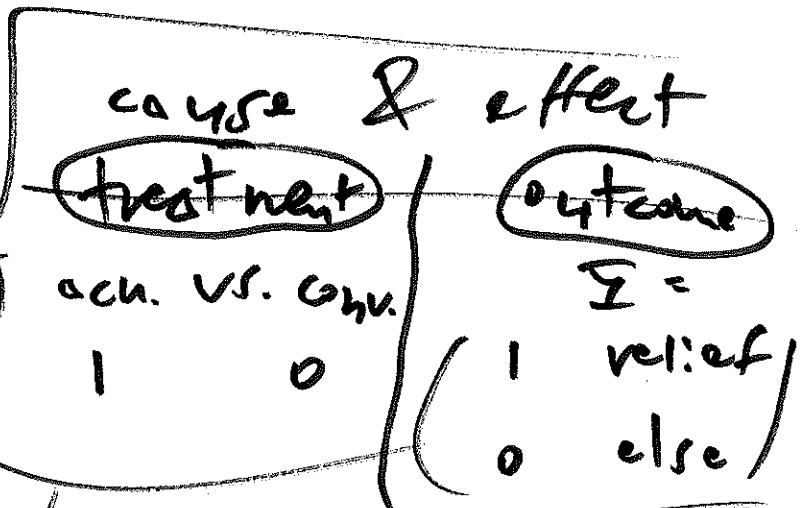
quant. | cont. | ratio

④ how much relief have you received! (most inf.)

quant. ordinal	quant. ratio
none some most all	cont. ratio



This is a repeated-measures design (7)  
 ("each patient serves as her/his/their own control")



$\Sigma$  = potential confounding factors (PCFs)

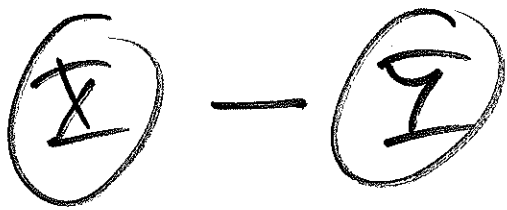
how to reject a PCF:

hold it constant

Def. if  $X \uparrow$ , on average  $Y \uparrow$  or  $\downarrow$ ,  $X$  and  $Y$  are associated (there is an association between  $X$  and  $Y$ )

d: Has Dr. Lo established an assoc. between her  $X$  & her  $Y$ ?  
 A: yes

an assoc. between her  $X$  & her  $Y$ ?



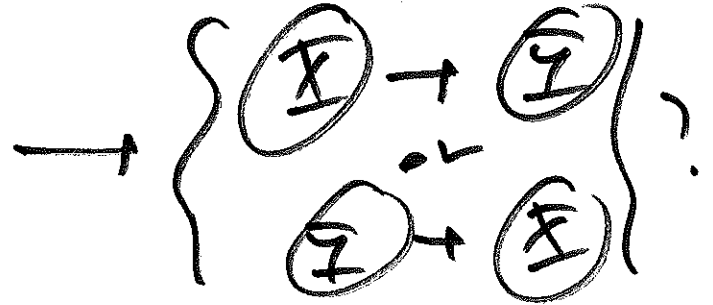
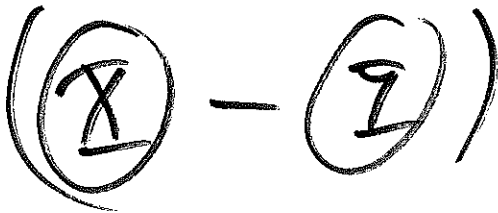
X, Y assoc.



X causes Y

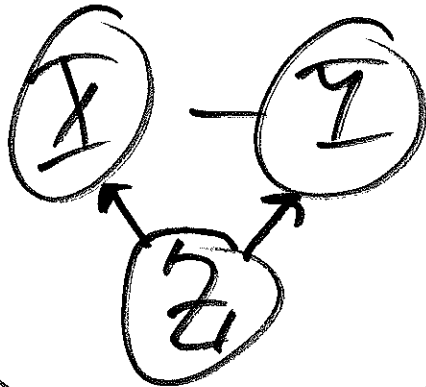
(10)

Q:



A:

unfortunately, no



association  $\neq$  causation

$\Leftarrow$  is weaker than  
or equivalent  
to



devil's advocate

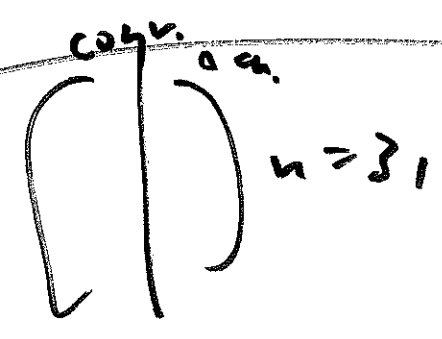
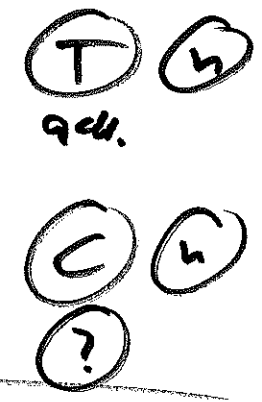
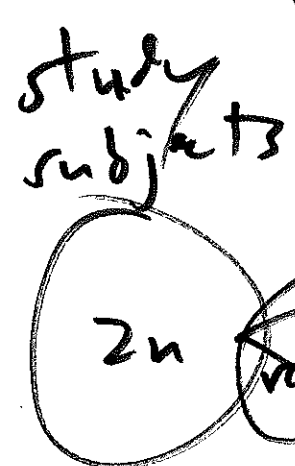
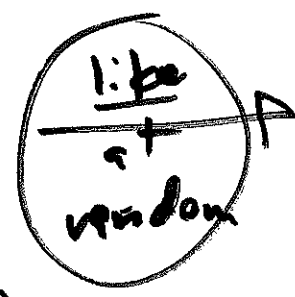
① randomized controlled trial (RCT) : simplest valid

design for concluding causality

correctly

completely randomized design

population  
we want to generalize here  
( $N \gg 2n$ )



① threat to validity:

possible lack of generalizability

placebo effect:

5.  $X = \begin{cases} 1 & \text{eating cottage cheese} \textcircled{10} \\ 0 & \text{not} \end{cases}$

$Y = \begin{cases} 1 & \text{fat} \\ 0 & \text{not} \end{cases}$

is it possible that  $X \rightarrow Y$ ?

is it possible that  $Y \rightarrow X$ ?  
yes

is it possible that  $X \rightarrow Y$ ?

suppose yes

is it possible that  $Y \rightarrow X$ ?

yes & much more plausible