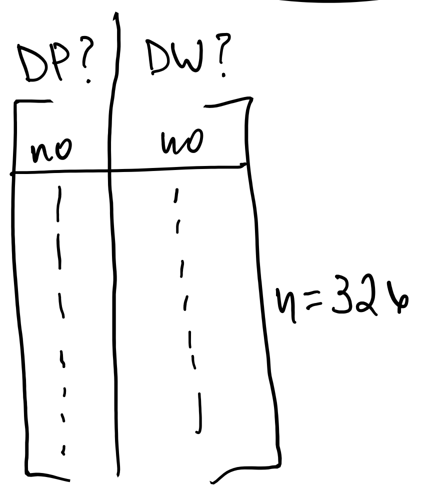
4/16/19

Tuesday, April 16, 2019 1:30 PM

See Syllabus

2x2 Contingency table

top table

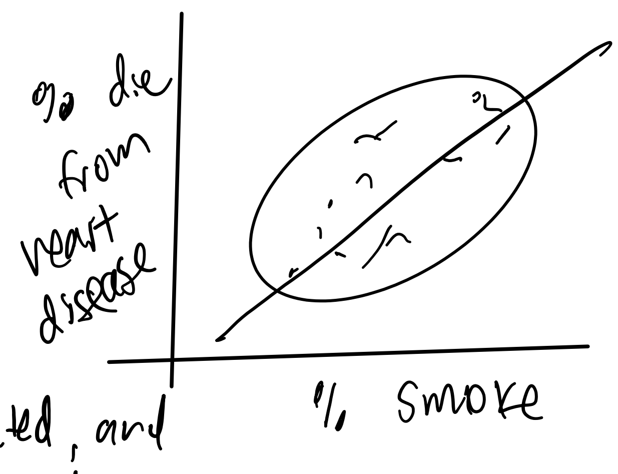


(a) $P(\text{death penalty}) = \frac{36}{326} = 11.0\%$

$P(\text{death penalty} \mid \text{white}) = \frac{19}{160} = 11.9\%$

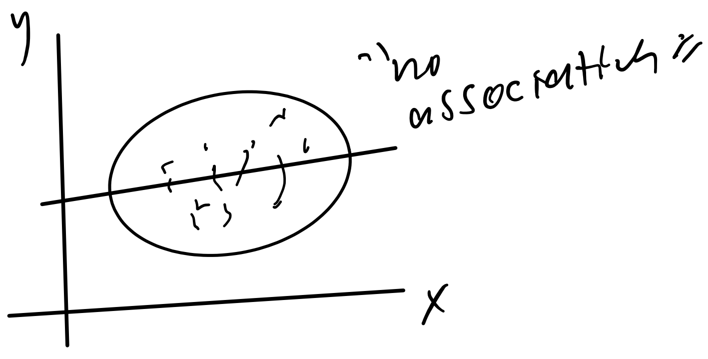
$P(\text{death penalty} \mid \text{black}) = \frac{17}{166} = 10.2\%$

→ observational study



1 point for each country

"positive association"



"confounding factors"

• third Z variable that satisfies two properties:

1. Z and X are associated, and
2. Z and Y are associated

⇒ holding "CF" constant is also known as "controlling"

Y = outcome $= \{DP, \text{not } DP\}$ $X = \{DW, \text{not } DW\}$?

observational study

enemy: potential (PCFS) $Z_1 = \{VW, \text{not } VW\}$

$P(DP \mid VW) = \frac{30}{214} = 14.0\%$

$P(DP \mid VW, DW) = \frac{19}{151} = 12.6\%$

$P(DP \mid VW, DB) = \frac{11}{63} = 17.5\%$

$P(DP \mid VB) = \frac{6}{112} = 5.4\%$

$P(DP \mid VB, DW) = \frac{0}{9} = 0\%$

$P(DP \mid VB, DB) = \frac{6}{103} = 5.8\%$

"Simpson's paradox"

Permutations & Combinations

311,875,200 permutations of 5 card hands

$P_{n,k} = n(n-1)\cdots(n-k)$

$n(n-1)\cdots 1 = n!$ read "n factorial"

$P_{n,k} = \frac{n!}{(n-k)!}$ $\boxed{\text{Convention}}$: $0! = 1$

toy sachs $\{ T_1, N_1 N_2 N_3 N_4 \}$

Definition: given a set of n elements, each distinct subset of size k is called a combination of elements, and therefore $C_{n,k} = \frac{n!}{k!(n-k)!}$ ways to do this

$\frac{n!}{k!(n-k)!} = \binom{n}{k}$ "n choose k"

Birthday Case Study

Let k = # people registered

$n = 365$ = # possible birthdays

Sample Space S has n^k equally likely outcomes

$(\text{not } A) = P_{n,k} = \frac{n!}{(n-k)!}$

$P(A) = 1 - P(\text{not } A) = 1 - \frac{365!}{272! \, 365^{93}}$

Stirling's Approximation: $\frac{1}{2}\log 2\pi + (n+\frac{1}{2})\log n - n$

Gamma function: generalization of $n!$

$n! = \Gamma(n+1)$

$\boxed{\text{Definition}}$: A multinomial coefficient is of the form

$$\binom{n}{n_1, n_2, \ldots, n_k} = \frac{n!}{n_1!\, n_2! \cdots n_k!}$$

• multinomial probability distribution