

Probability with Tables

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FREC 408

Rules so far

Probability of
A Union $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Conditional
Probability $P(A|B) = \frac{P(A \cap B)}{P(B)}$

Probability
of an
Intersection $P(A \cap B) = P(B)P(A|B)$

Cross-Tab of Treatment Type versus Still Smoking After 8 Weeks

We have a cross-tabulation of Treatment by Still
Smoking after 8 weeks

	Yes	No	Row Total
Nicotine Patch	64	56	120
Placebo	96	24	120
Column Total	160	80	240

Handout of Class Data

- Let Event A = Received a Nicotine Patch.
- What is the probability of Event A?

$$P(A) = 120/240 = .50$$

Union of Events A and B

- What is the union of Events A (Received Nicotine Patch) and B (No Longer Smoking)
- $(A \cup B) =$
- _____ Everyone who received the patch
- + _____ Everyone who no longer smokes
- _____ Everyone who is both

Union of Events A and B

- 120 Everyone who received the patch
- 80 Everyone no longer smoking
- 56 Everyone who is both – this is the INTERSECTION
- 144 $(A \cup B)$

Probability of the Union of Events A and B

$$P(A \cup B) = 144/240 = .60$$

Intersection of Receiving the Patch Versus No Longer Smoking

- What is the Intersection Receiving the Patch Versus No Longer Smoking?
- $(A \cap B)$
- 56 Everyone who both received the nicotine patch and is no longer smoking
- $P(A \cap B) = 56/240 = .233$

Let's do a check using formulas

Probability of A Union $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$P(A) = .50$$

$$P(B) = .333$$

$$P(A) + P(B) = .833$$

$$P(A \cap B) = .233$$

$$P(A \cup B) = .833 - .233 = .60$$

Conditional Probability

- A Conditional Probability statement would be "The probability of No Longer Smoking given you received the Nicotine Patch" and is defined as

$$P(B | A) = \frac{P(A \cap B)}{P(A)}$$

Conditional Probability

- The probability of No Longer Smoking given you received the Nicotine Patch

$$P(B|A) = \frac{P(A \cap B)}{P(A)}$$

$$P(B|A) = .233 / .50 = .467$$

Conditional Probability in a Table

- Note: I can solve for the $P(A|C)$ directly, as long as I understand how to percentage my table
- There are 120 who received the Nicotine Patch in the study – see the number in the row margin
 - This is the given, as in *given you received the Nicotine Patch*

Conditional Probability in a Table

- And 56 of those that received the patch were not smoking after 8 weeks
- So, $56/120 = .467$
- In a cross-tab this is called the **row percentage**
- It is the conditional probability, conditioned on the row attribute

Conditional Probability in a Table

We have a cross-tabulation of Treatment by Still Smoking after 8 weeks

	Yes	No	Row Total
Nicotine Patch	64	56	120
Placebo	96	24	120
Column Total	160	80	240

$56/120 = .467$ which is the row proportion

The Complement of A

- The Complement of A would be "Received the Placebo"
 - Denoted as A^c
 - aka "Placebo"
- What is the $P(A^c)$ and $P(A^c \cap B)$?

$$P(A^c) = .50$$

$$P(A^c \cap B) = 24/240 = .10$$

Conditional Probability for A^c

- The probability of No Longer Smoking given you received the Placebo

$$P(B|A^c) = \frac{P(A^c \cap B)}{P(A^c)}$$

$$P(B|A^c) = .10 / .50 = .20$$

$$\text{Also: } 24/120 = .20$$