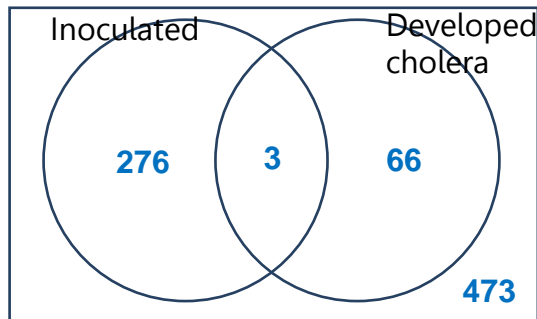


## 4.1: Contingency Tables and Probability - SOLUTIONS

Group Activity**Cholera Inoculation Study, 1894-96:**

A group of 818 people who were exposed to cholera in Calcutta, India in 1894-6 were studied. Of this group, 279 were inoculated with Haffkine's anti-cholera vaccine, while the remaining 539 had not been inoculated. Overall, 69 people developed cholera. Three of those who were vaccinated developed cholera. Use this information to complete the Venn diagram and the contingency table. (Source: <https://mysite.du.edu/~jcalvert/econ/twobytwo.htm>)



	Developed cholera	Did not develop cholera	Total
Inoculated	3	276	279
Not inoculated	66	473	539
Total	69	749	818

1. Find the marginal, "and," and "or" probabilities. If a randomly selected person from the study was chosen, what is the probability they:

MARGINAL

a. were inoculated?

$$P(\text{inoculated}) = 279/818 = .3411$$

b. developed cholera?

$$P(\text{cholera}) = 69/818 = .0844$$

AND

c. were inoculated and developed cholera?

$$P(\text{inoculated and cholera}) = 3/818 = .0037$$

d. were not inoculated and did not develop cholera?

$$P(\text{not inoculated and no cholera}) = 473/818 = .5782$$

OR

e. were inoculated or did not develop cholera?

$$P(\text{inoculated or no cholera}) = (3+276+473)/818 = .9193$$

f. were not inoculated or developed cholera?

$$P(\text{not inoculated or cholera}) = (3+66+473)/818 = .6626$$

CONDITIONAL

g. Given that a person was inoculated, what is the probability they developed cholera?

$$P(\text{cholera given inoculated}) = 3/279 = .0108$$

h. If a person was not inoculated, what is the probability they developed cholera?

$$P(\text{cholera given not inoculated}) = 66/539 = .1224$$

i. Do you think the vaccine was effective? Why or why not?

**The chance of getting cholera if vaccinated is about 1% versus 12% if not vaccinated. It seems like the vaccine was effective.**

**Our Class Data:**

The survey data below is from four classes of Math 105 students. Their gender identities and modes of transportation to PCC are summarized in a contingency table.

	Bike	Bus	Drive Self	Ride with Another	Walk	Total
Female	0	12	25	5	3	45
Non-binary or Genderqueer	0	3	2	0	0	5
Male	1	4	16	3	1	25
Total	1	19	43	8	4	75

2. Find the following marginal, "and", and "or" probabilities.

If we were to randomly select a student who took the survey, what is the probability they:

a. identify as female?

$$P(\text{female}) = 45/75 = .6$$

b. identify as non-binary or genderqueer?

$$P(\text{non-binary or genderqueer}) = 5/75 = .0667$$

c. walk to PCC?

$$P(\text{walk}) = 4/75 = .0533$$

d. bus to PCC?

$$P(\text{bus}) = 19/75 = .2533$$

e. walk and identify as male?

$$P(\text{walk and male}) = 1/75 = .0133$$

f. identify as non-binary or genderqueer and drives them self to PCC?

$$P(\text{non-binary or genderqueer and drives self}) = 2/75 = .0267$$

g. identify as female or ride with another?

$$P(\text{female or ride with another}) = (12+25+5+3+3)/75 = 48/75 = .64$$

h. identify as male or walk to PCC?

$$P(\text{male or walk}) = (1+4+16+3+1+3)/75 = 28/75 = .3733$$

3. Calculate these conditional probabilities:

a. Given that a student from the survey identifies as female, what is the probability they take the bus to PCC?

$$P(\text{bus given female}) = 12/45 = .2667$$

b. If a student drives them self to campus, what is the probability they identify as non-binary or genderqueer?

$$P(\text{non-binary or genderqueer given drives self}) = 2/43 = .0465$$

c. What is the probability that a student walks, given they identify as male?

$$P(\text{walk given male}) = 1/25 = .04$$

d. Of those students who identify as female, what is the probability they ride to campus with another?

$$P(\text{ride with another given female}) = 5/45 = .1111$$