Question

The company is conducting a survey to determine the spread of two strains of viruses (type A and type B) in a certain wing of a hospital. Out of 450 patients,
267 tested positive to virus A
253 tested positive to virus B
40 tested negative to both

Draw a Venn diagram to represent all the information collected in the survey.

1. If one patient is chosen at random, what is the probability that the patient tested is negative to both A and B?

Find the probability that a patient chosen at random:
2. Tested positive to virus A only.
3. Tested positive to virus A given that he/she tested positive to virus B.

Solution
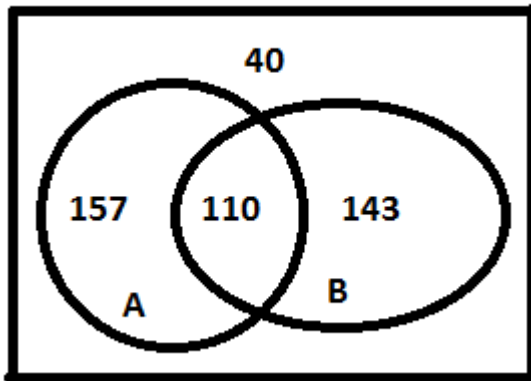
$$|A| + |B| + |\overline{A \ or \ B}| - |A \ and \ B| = |U|,$$

where $|A| = 267, |B| = 253, |\overline{A \ or \ B}| = 40, |U| = 450$.

Number of positive to both is

$$|A \ and \ B| = |A| + |B| + |\overline{A \ or \ B}| - |U| = 267 + 253 + 40 - 450 = 110.$$

Number of positive to A only is

$|A\backslash B| = |A| - |A \ and \ B| = 267 - 110 = 157.$

Number of positive to B only is

$|B\backslash A| = |B| - |A \ and \ B| = 253 - 110 = 143.$

1. $P(not \ A \ and \ not \ B) = \frac{40}{450} \approx 0.089.$

2. $P(A \ and \ notB) = \frac{157}{450} \approx 0.349.$

3. $P(A|B) = \frac{P(A \ and \ B)}{P(B)} = \frac{\frac{110}{450}}{\frac{253}{450}} = \frac{110}{253} \approx 0.435.$

Answer:

1. $\frac{40}{450}$;

2. $\frac{157}{450}$;

3. $\frac{110}{253}$.