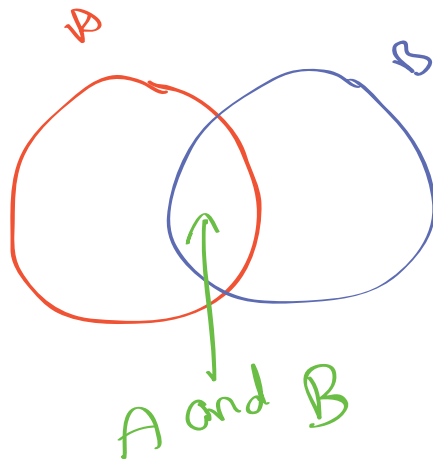


# Conditional probabilities

$$Pr[B|A]$$



A = woman gets breast cancer

B = woman uses hormone replacement therapy (HRT)

$Pr[A] = 1/9$  (prior prob. of BC in the population of women)

$Pr[B] = 1/20$  (prior prob women use HRT in the population)

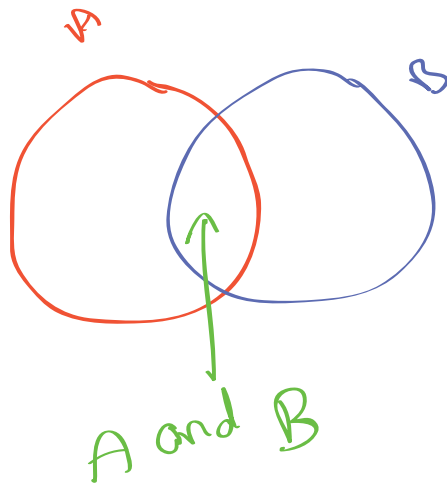
$$Pr[A \cap B] =$$

# Conditional probabilities

$$Pr[B|A]$$

prob. of B  
given that  
A has occurred.

The conditional probability of an event B in relationship to an event A is the probability that B occurs given that A has already occurred.



Consider

$$\frac{Pr[A \text{ and } B]}{Pr[A]}$$

$$\left( \overset{\uparrow}{=} Pr[B|A] \right)$$

e.g.

A = rain?

B = street is wet?

e.g.

A = Mike in goal

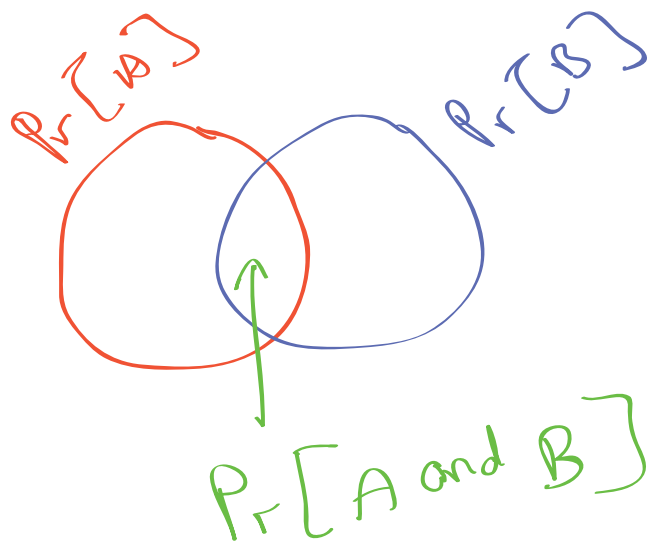
B = score

# Conditional probabilities

$$Pr[B|A]$$

prob. of B  
given that  
A has occurred.

The conditional probability of an event B in relationship to an event A is the probability that B occurs given that A has already occurred.



Consider

$$\frac{Pr[A \text{ and } B]}{Pr[A]}$$

$$\left( \uparrow = Pr[B|A] \right)$$

e.g.

A = rain?

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e.g.

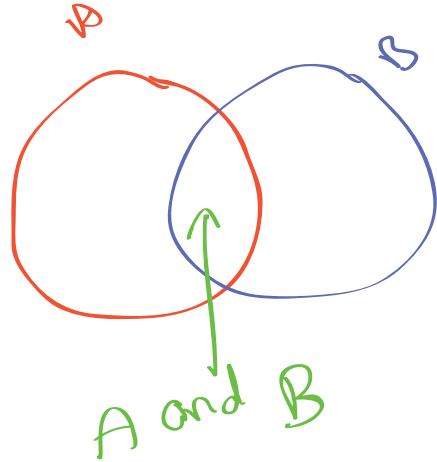
A = Mike in goal

B = score

# Conditional probabilities

$$\Pr[B|A]$$

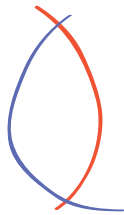
prob. of B  
given that  
A has occurred.



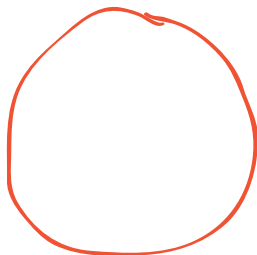
$$= \frac{\Pr[A \text{ and } B]}{\Pr[A]}$$

Of all the times that A occurs, what fraction does B also occur?

size of A and B



size of A



## NBCs (cont)

$$P_{\text{posterior}} = \frac{\text{Likelihood} \times \text{Prior}}{\text{Evidence}}$$

$$Pr[\text{Outcome} \mid ER, Herz, LW, \text{grade}]$$

$$= \left[ Pr[ER \mid \text{Outcome}] \cdot Pr[Herz \mid \text{Outcome}] \cdot Pr[LW \mid \text{Outcome}] \cdot Pr[\text{Grade} \mid \text{Outcome}] \right] \cdot Pr[\text{Outcome}]$$

---

$$Pr[ER, Herz, LW, \text{Grade}]$$

## NBCs (cont)

$$P_{\text{posterior}} = \frac{\text{Likelihood} \times \text{Prior}}{\text{Evidence}}$$

$$\left[ \begin{aligned} & \Pr[ER | outcome] \cdot \Pr[Her2 | outcome] \\ & \cdot \Pr[LN | outcome] \\ & \cdot \Pr[Grade | outcome] \end{aligned} \right]$$

