

Conditional Probabilities and Independence

On homework 4, problem 2 dealt with a study on tanning and skin cancer. Below is the data from that study.

	Have skin cancer?		
Use tanning devices?	Yes	No	
Yes	190	75	265
No	706	465	1171
	896	540	1436

If a person is selected at random from this group of 1436 people, what is the probability that ...

- a) The person has skin cancer?

$$P(\text{skin cancer}) = \frac{896}{1436} = 0.624$$

- b) The person has skin cancer given they use tanning devices?

$$P(\text{skin cancer} \mid \text{tanning}) = \frac{190}{265} = 0.717$$

- c) The person uses tanning devices?

$$P(\text{tanning}) = \frac{265}{1436} = 0.185$$

- d) The person uses tanning devices given they have skin cancer?

$$P(\text{tanning} \mid \text{skin cancer}) = \frac{190}{896} = 0.212$$

- e) Are the events skin cancer and using tanning devices independent? Justify your answer.

No, because the unconditional probability of having skin cancer is not the same as the conditional probability of having skin cancer given use of tanning devices. No, because the unconditional probability of using tanning devices is different from the conditional probability of using tanning devices given skin cancer.

$$P(\text{skin cancer}) = 0.624 \neq 0.717 = P(\text{skin cancer} \mid \text{tanning})$$

$$P(\text{tanning}) = 0.185 \neq 0.212 = P(\text{tanning} \mid \text{skin cancer})$$