

## MMV Question

From googling, I found that the Bayes theorem is a good equation for determining conditional probability (i.e. likelihood of an outcome occurring, based on a previous outcome occurring). The example for cancer symptoms on the Wikipedia page ([https://en.wikipedia.org/wiki/Bayes%27\\_theorem](https://en.wikipedia.org/wiki/Bayes%27_theorem)) seems to follow the same format that could be applied in this scenario, so I based my equation off of that. The general equation is as follows:

$$P(A|B) = (P(B|A) \times P(A)) / P(B)$$

A,B = events

P(A|B) = probability of A given B is true

P(B|A) = probability of B given A is true

P(A), P(B) = the independent probabilities of A and B

In this case, if I subbed the variables to the MMV question into this equation then,

A or MMV = having MMV

B or pos = testing positive for MMV

P(A|B) or P(MMV|pos) = probability of having getting a positive test and actually having MMV

P(B|A) or P(pos|MMV) = probability of testing positive if you have MMV

P(A) or P(MMV) = probability of having MMV

P(B) or P(pos) = probability of testing positive

\*Note: for the probability of testing positive, P(pos), you need to add the probabilities of testing positive if you have MMV and the probability of testing positive if you don't have MMV. Since the prevalence of MMV in the population is 0.01, then the prevalence of not having MMV is 1-0.01=0.99.

If I sub in the variables and their probabilities, we get:

$$P(MMV|pos) = (P(pos|MMV) \times P(MMV)) / P(pos)$$

$$P(MMV|pos) = (P(pos|MMV) \times P(MMV)) / (P(pos|MMV) \times P(MMV) + (P(pos|no MMV) \times P(no MMV)))$$

$$P(MMV|pos) = (1 \times 0.01) / (1 \times 0.01) + (0.05 \times 0.99)$$

$$P(MMV|pos) = 0.168$$

$$P(MMV|pos) = 16.8\%$$

Therefore, if I pick a person from this population at random, and test them, and the test is positive, the probability that they actually have MMV is 16.8%.

If my friend got a positive test, I would tell them that there's an 82.3% chance you don't have MMV, but still be careful because you wouldn't want to spread MMV in case you actually do have it (which is a probability of 16.8%).