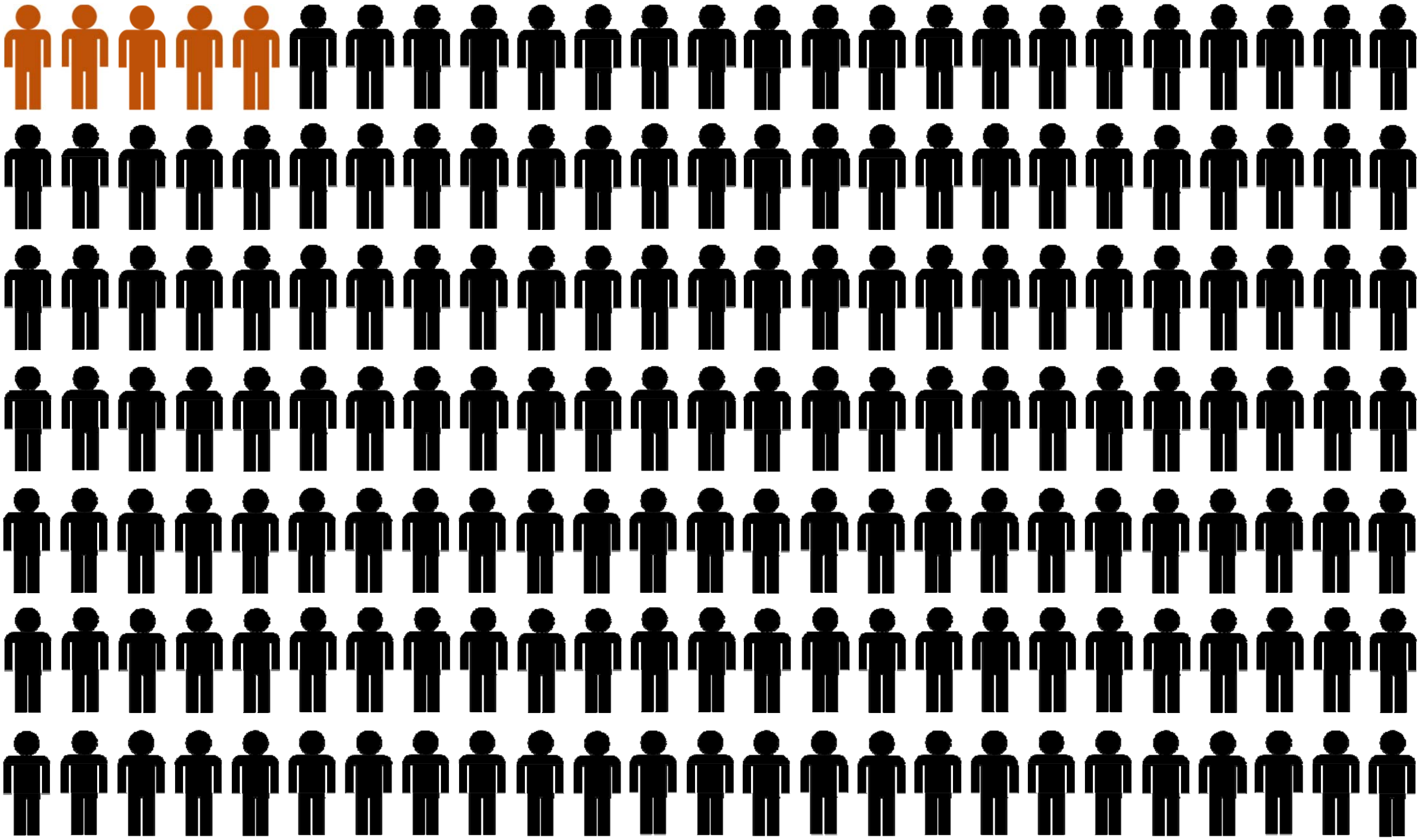
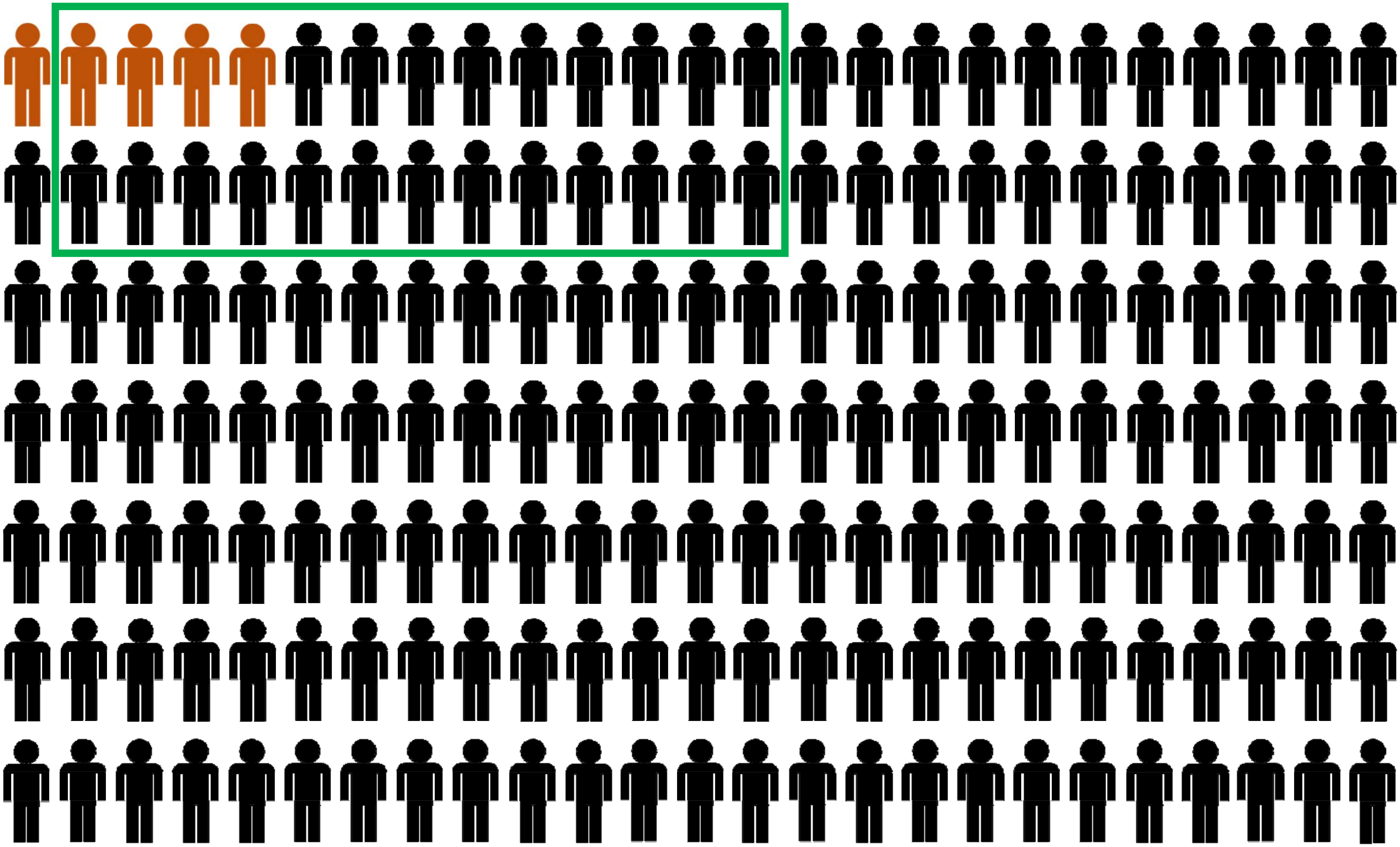
Bayesian Thinking

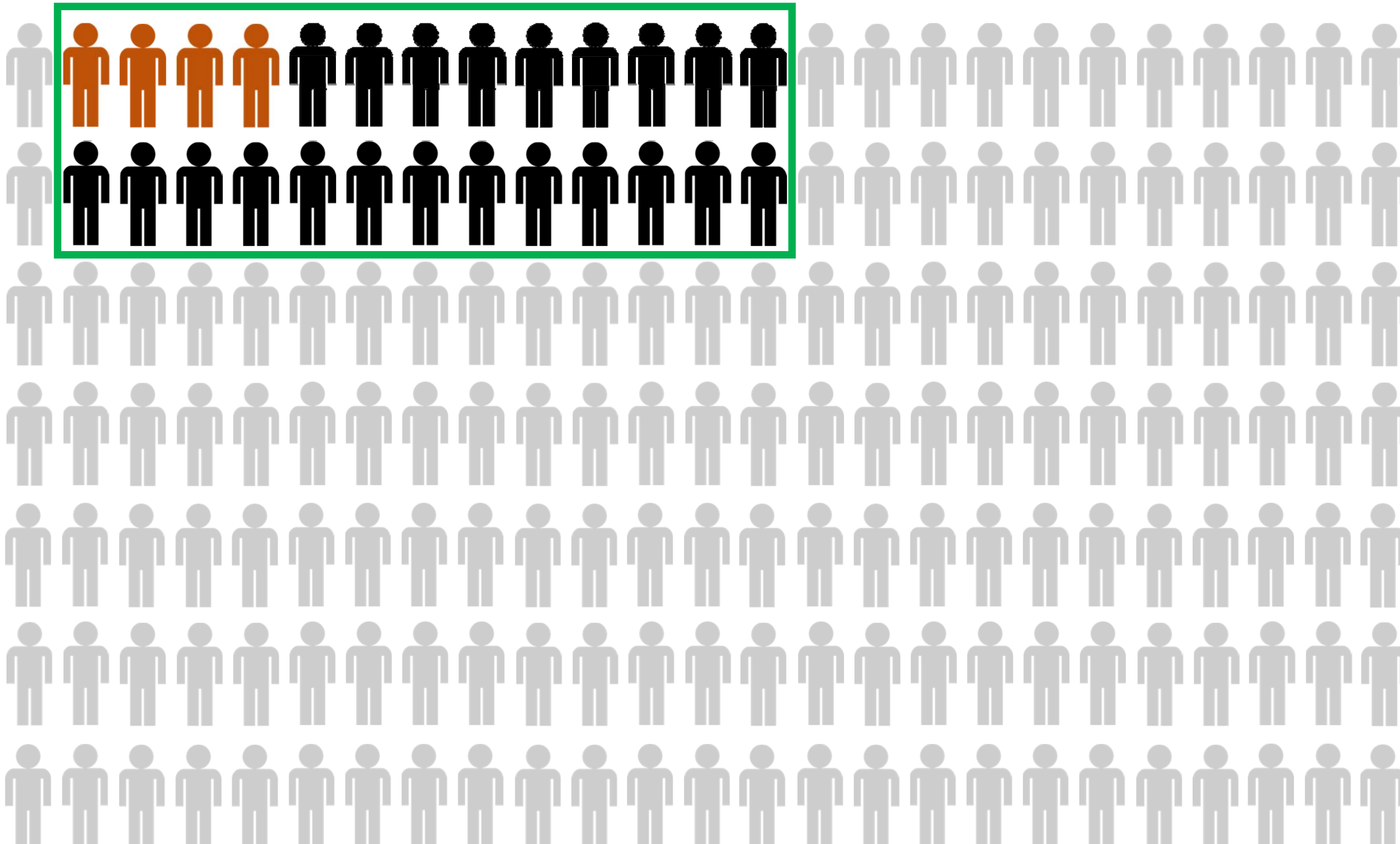
Taking prior probabilities into account is often smart thinking.

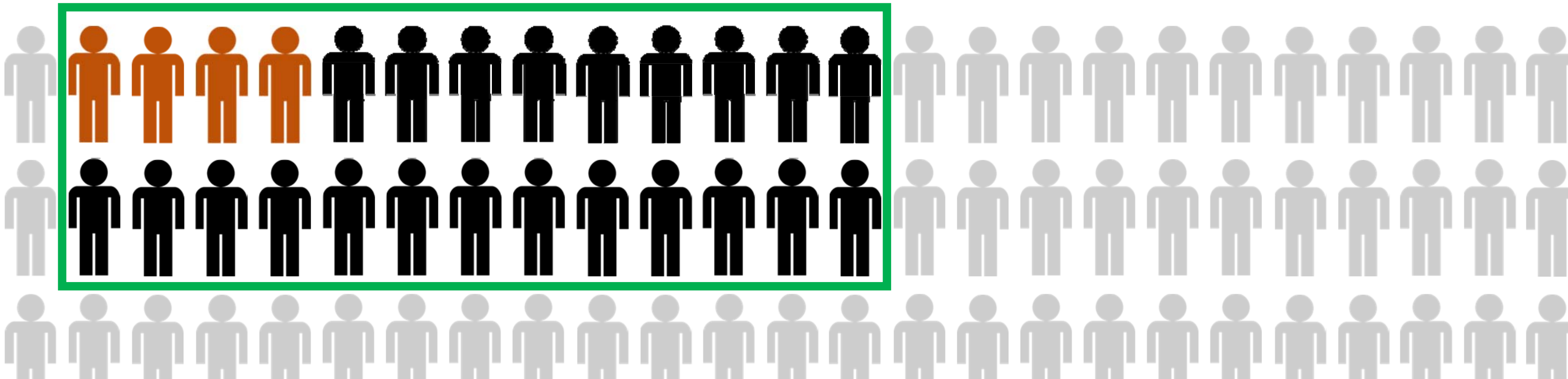
3% of people is sick
Test identifies 80%
of patients with 13%
false positive rate.

If the test is positive, how probable is it the patient is sick?



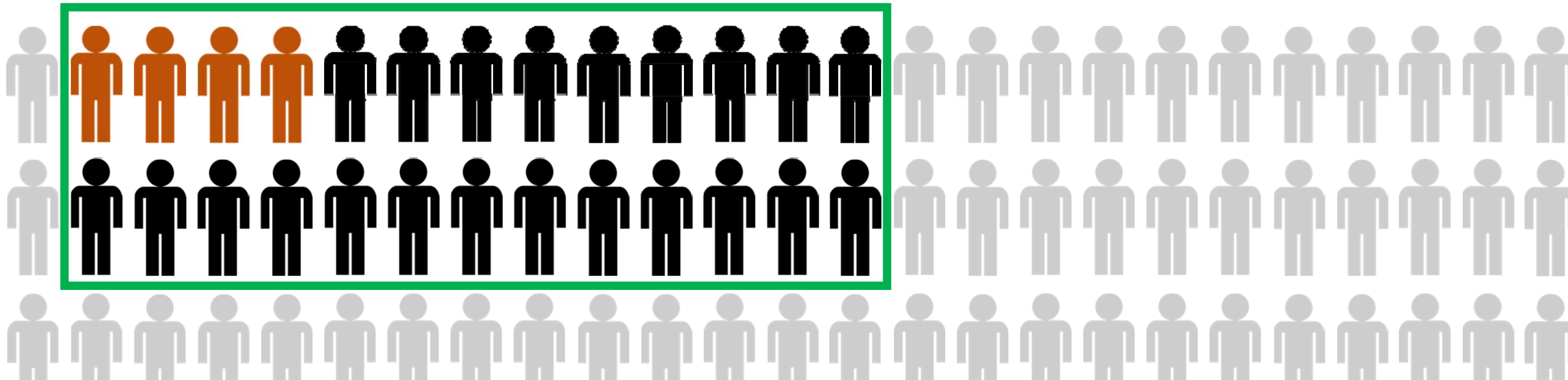






$$\frac{P(sick)}{P(\neg sick)} \times \frac{P(+\,|\,sick)}{P(+\,|\,\neg sick)} = \frac{P(sick\,|\,+)}{P(\neg sick\,|\,+)}$$

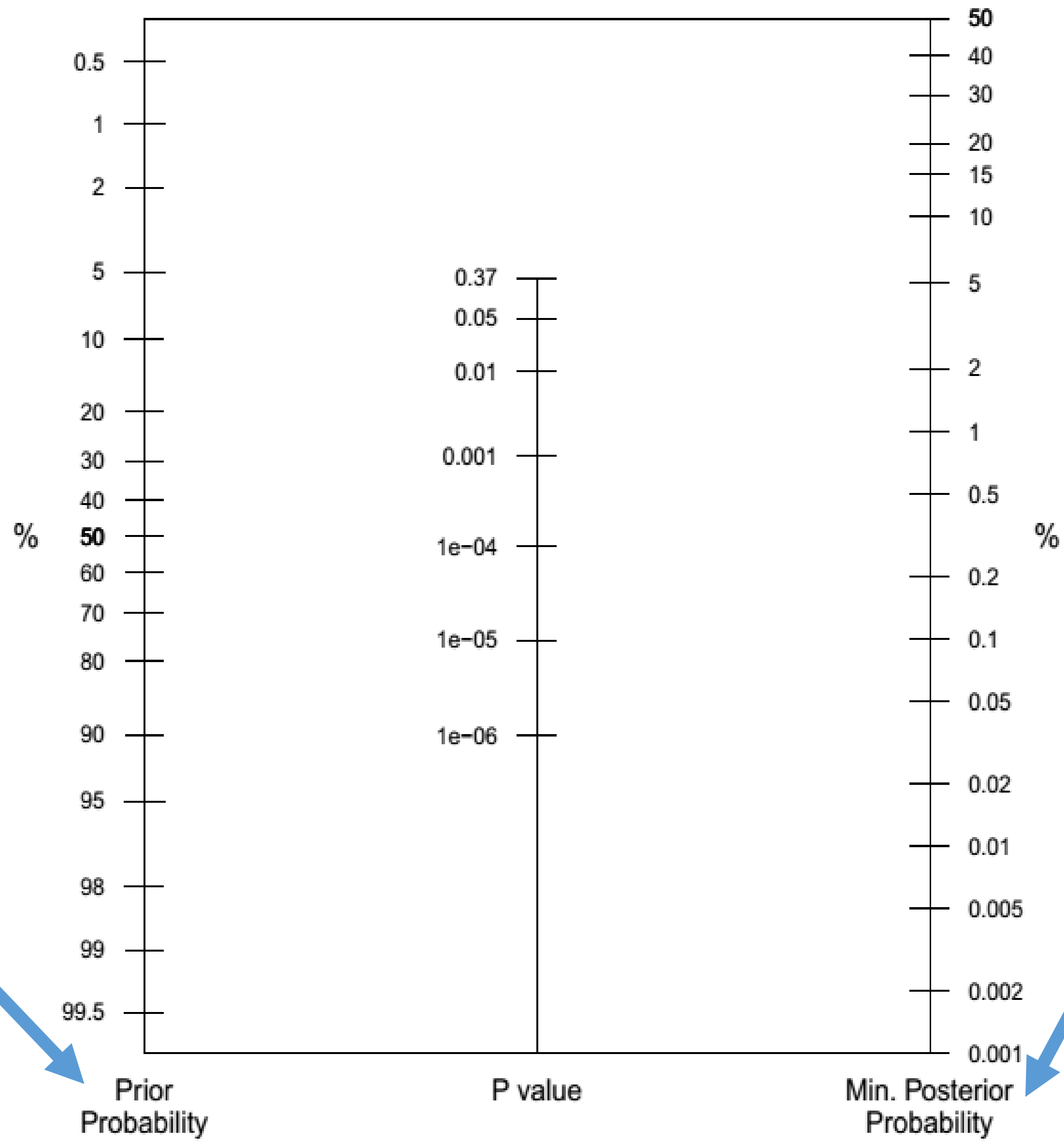
Prior × Likelihood = Posterior



$$\frac{5/175}{170/175} \times \frac{4/5}{22/170} = \frac{4/26}{22/26} = 0.18$$

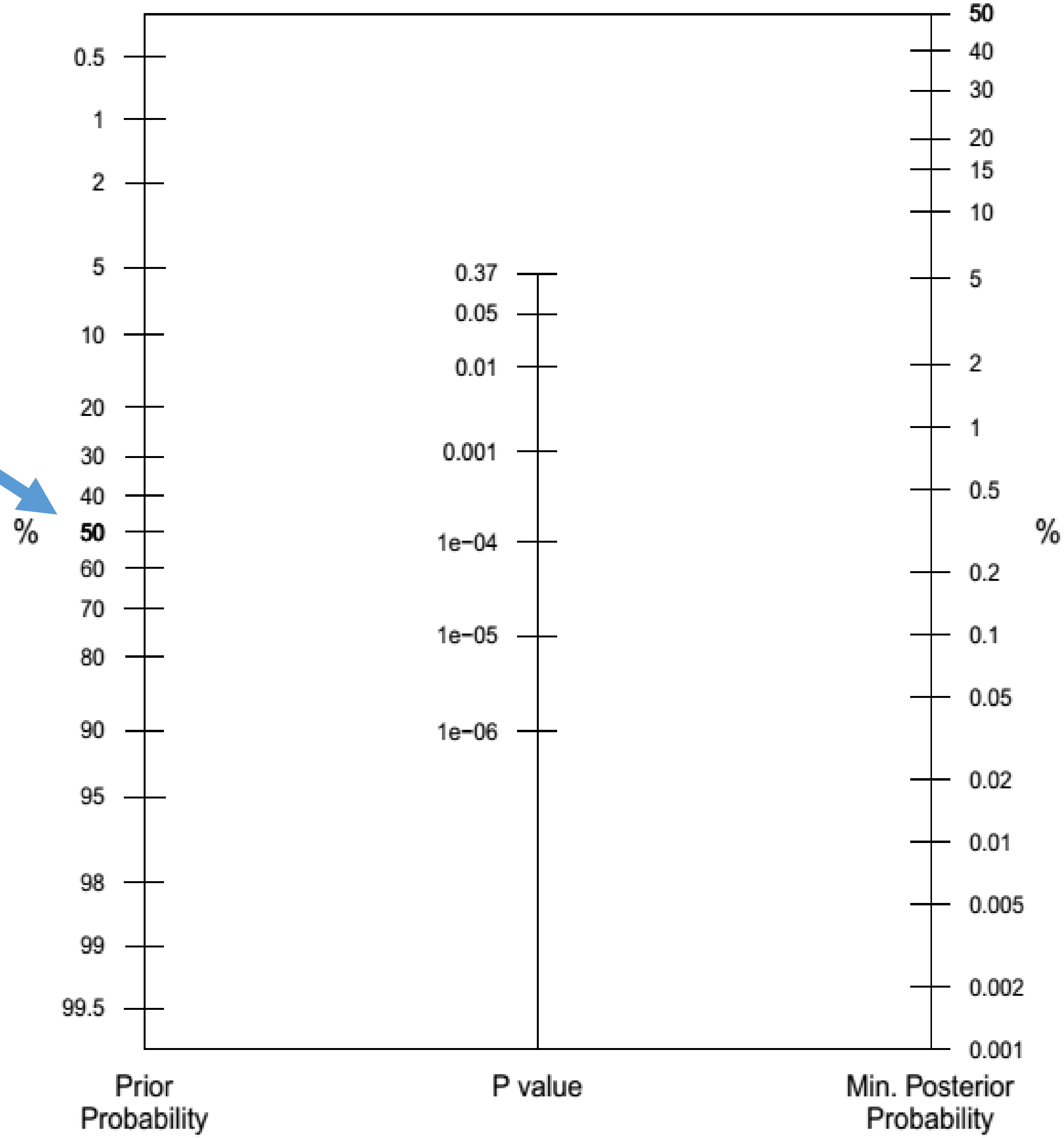
Taking prior information into account can lead to better inferences.

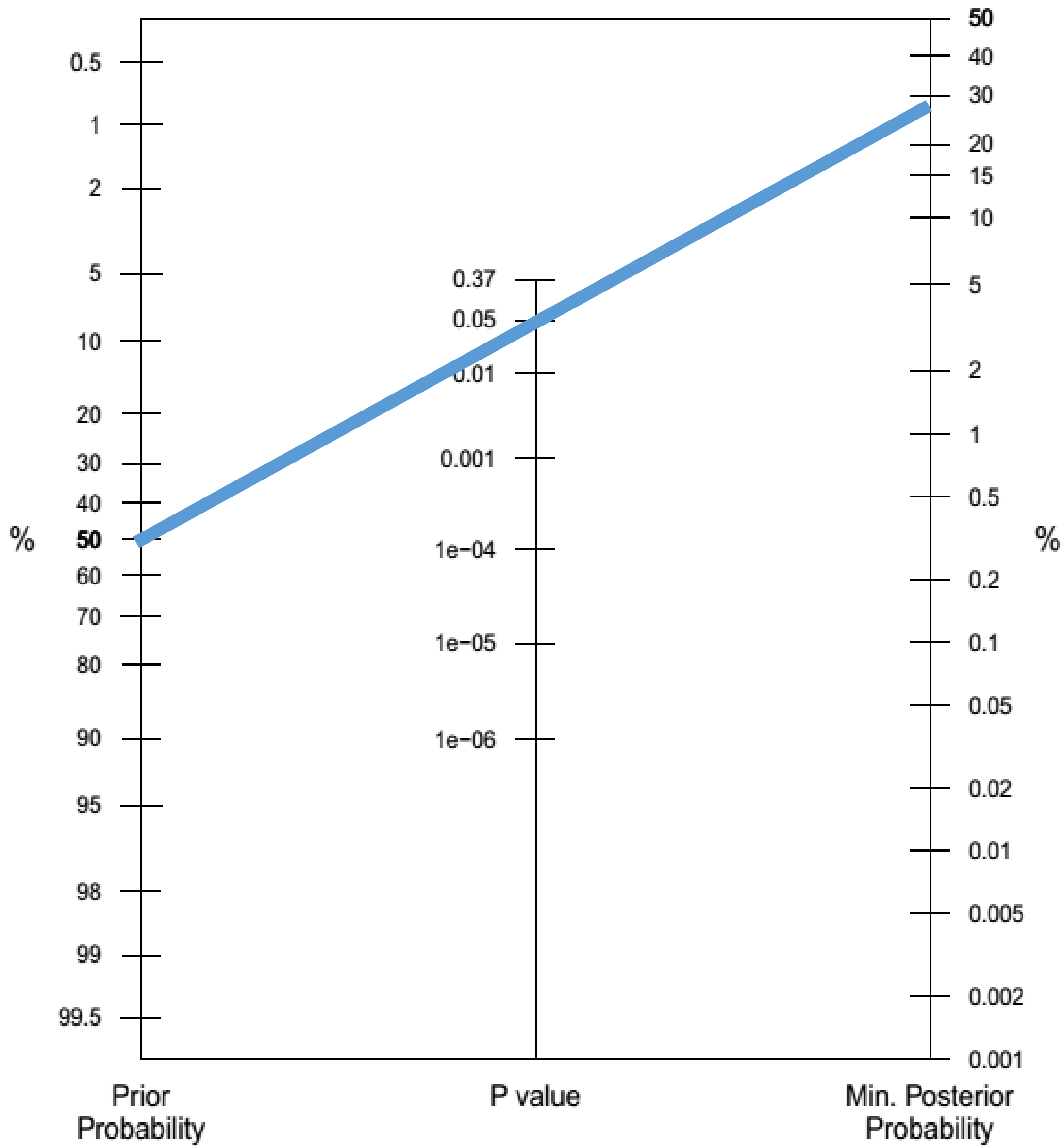
Prior Probability H0 is True



Posterior Probability H0 is True

Before collecting data, you believe there is a 50% probability H0 is true (it’s like flipping a coin)





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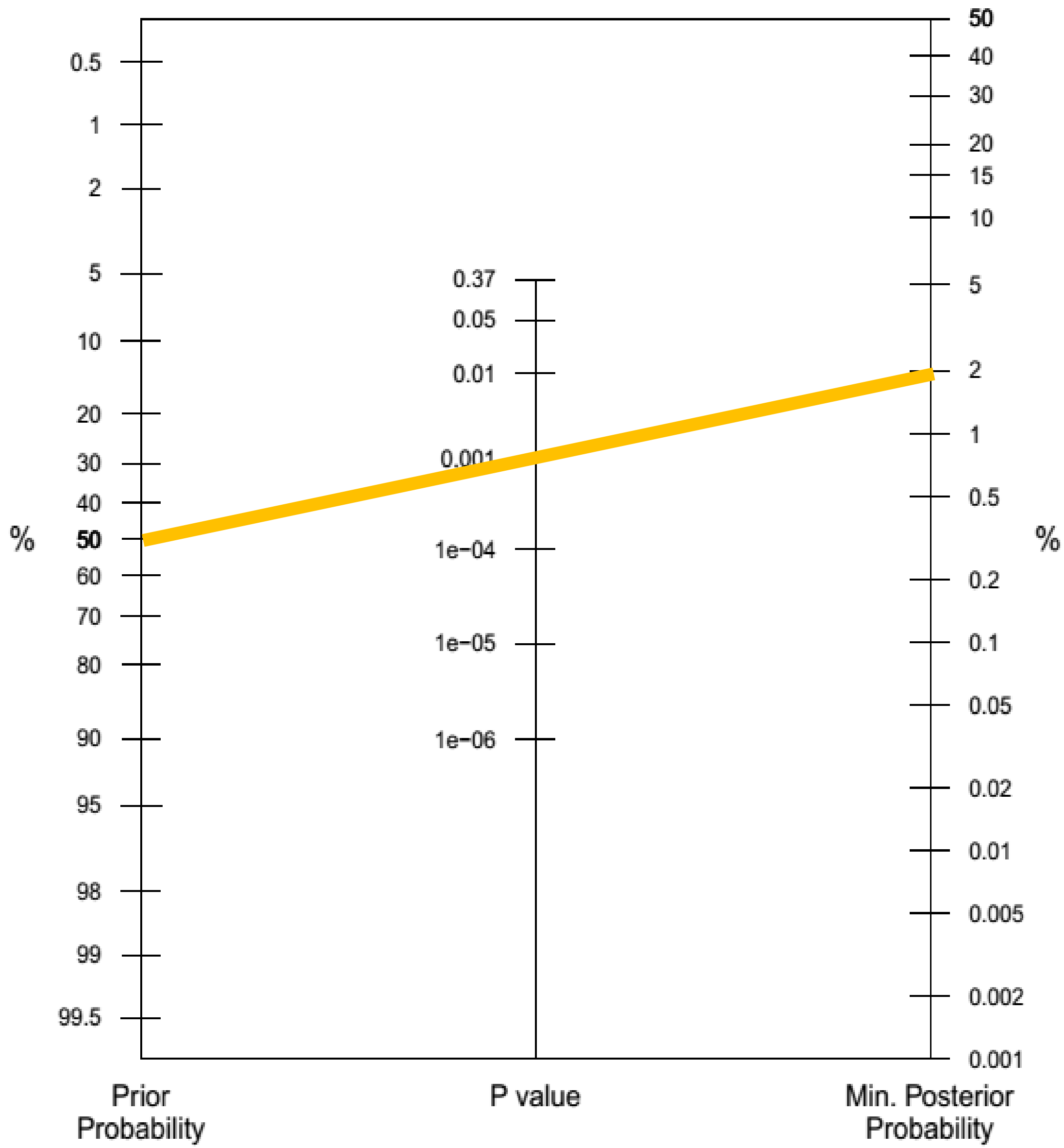
Prior Probability
P value
Min. Posterior Probability



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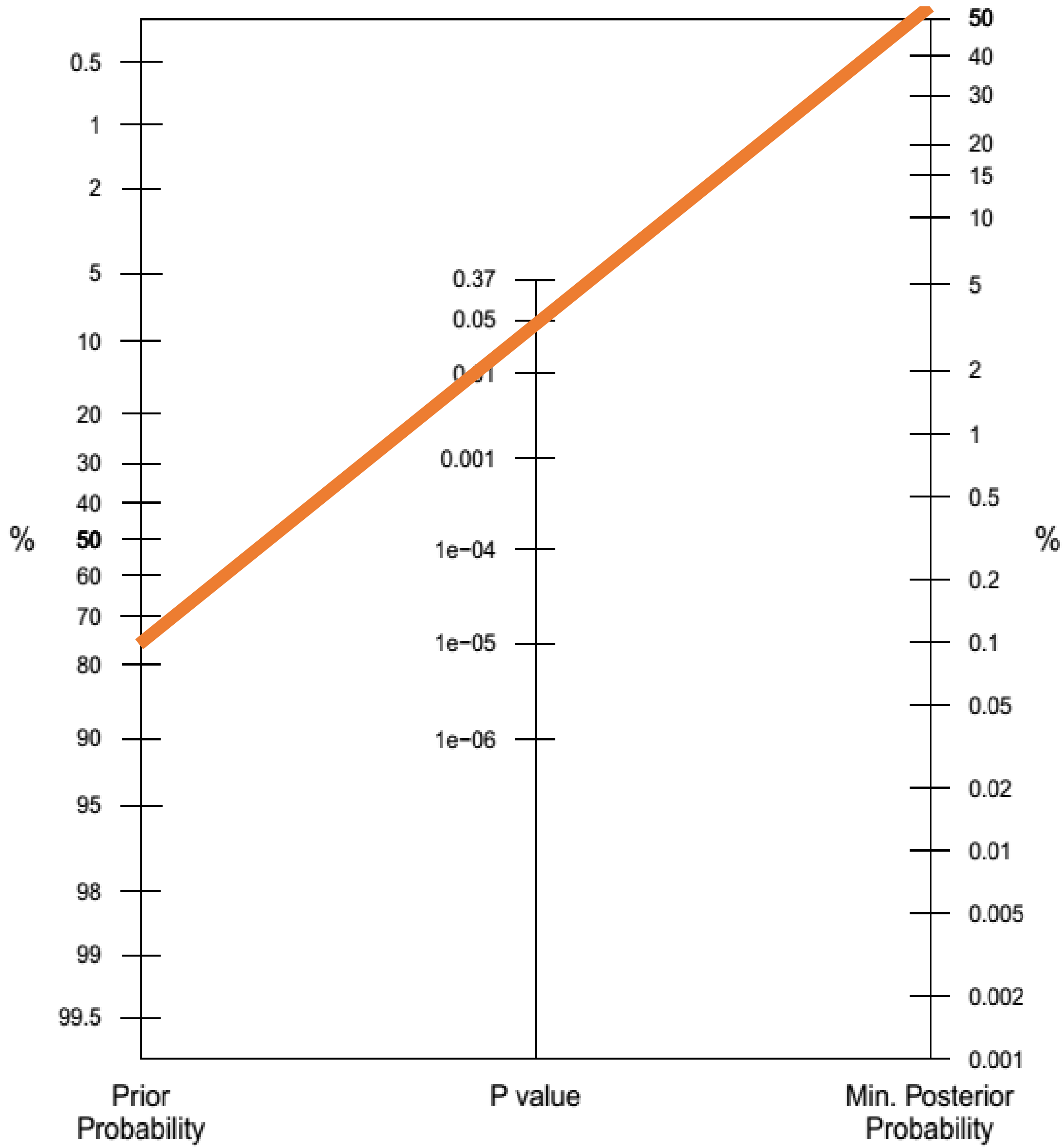
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Prior Probability
P value
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Extraordinary claims require extraordinary evidence

Laplace, 1812

Bayesian thinking, even without formal Bayesian statistics, is always a good idea.