Prevalence and Positive Predictive Value

[Adopt an Unicorn edition]

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TL;DR

The Positive Predictive Value (PPV; how much can I trust a + result) of an almost perfect test can vary wildly(*) depending on the Prevalence of the condition in the population tested.

(*) From 33% when the prevalence is 1 in 2000 [see here] to 100% when the prevalence is 1 in 1 [see here]

Unicorn Test
(almost extinct)

Hit rate: 100% (sensitivity)

False positives: 0,1% (1 - specificity)

Massive screening

Type 2 diabetes

Population A

1 out of 1000

Population B

500 out of 1000

Massive screening

Type 2 diabetes

Population A

1 out of 1000

Population A

Hit rate
100%

False
positives

0,1%

Prevalence

1 out of 1000

p(Disease|+)?

How much can I trust a + result?

<25% 25-49% 50% 51-75% >75%

Population A

Hit rate **100%**

False positives **0,1%**

Prevalence

1 out of 1000

p(Disease|+)?

How much can I trust a + result?

<25% 25-49% 50% 51-75% >75%

1 out of 1000

Hit rate **100%**

1 out of 1000

False positives **0,1%**

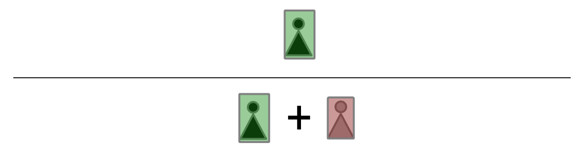
PPV = 50%

Hit rate **100%**

1 out of 1000

False positives **0,1%**

$$\frac{\text{TRUE +}}{\text{TRUE +} \; + \; \text{FALSE +}} =$$



Hit rate **100%**

1 out of 1000

False positives **0,1%**

$$p(H|D)=\frac{p(H).\,p(D|H)}{p(H).\,p(D|H)+p(\bar{H}).\,p(D|\bar{H})}$$

PPV = 50%

Hit rate **100%**

1 out of 1000

False positives
0,1%

$$p(H|D)=\frac{p(H).p(D|H)}{p(H).p(D|H)+p(\bar{H}).p(D|\bar{H})}$$

PPV = 50%

Hit rate **100%**

1 out of 1000

False positives **0,1%**

$$p(H|D)=\frac{0.1\% \cdot 100\%}{0.1\% \cdot 100\% + 99.9\% \cdot 0.1\%}$$

PPV = 50%

<u>Massive screening</u>

Type 2 diabetes

Population B

500 out of 1000

Population B

Hit rate
100%

False positives
0,1%

Prevalence
500 out of 1000

p(Disease|+)?

How much can I trust a + result?

<25% 25-49% 50% 51-75% >75%

Population B

Hit rate
100%

False positives
0,1%

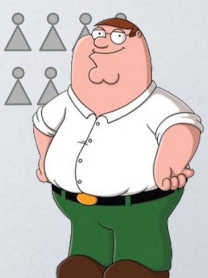
Prevalence
500 out of 1000

p(Disease|+)?

How much can I trust a + result?

<25% | 25-49% | 50% | 51-75% | >75% **(99,8%)**

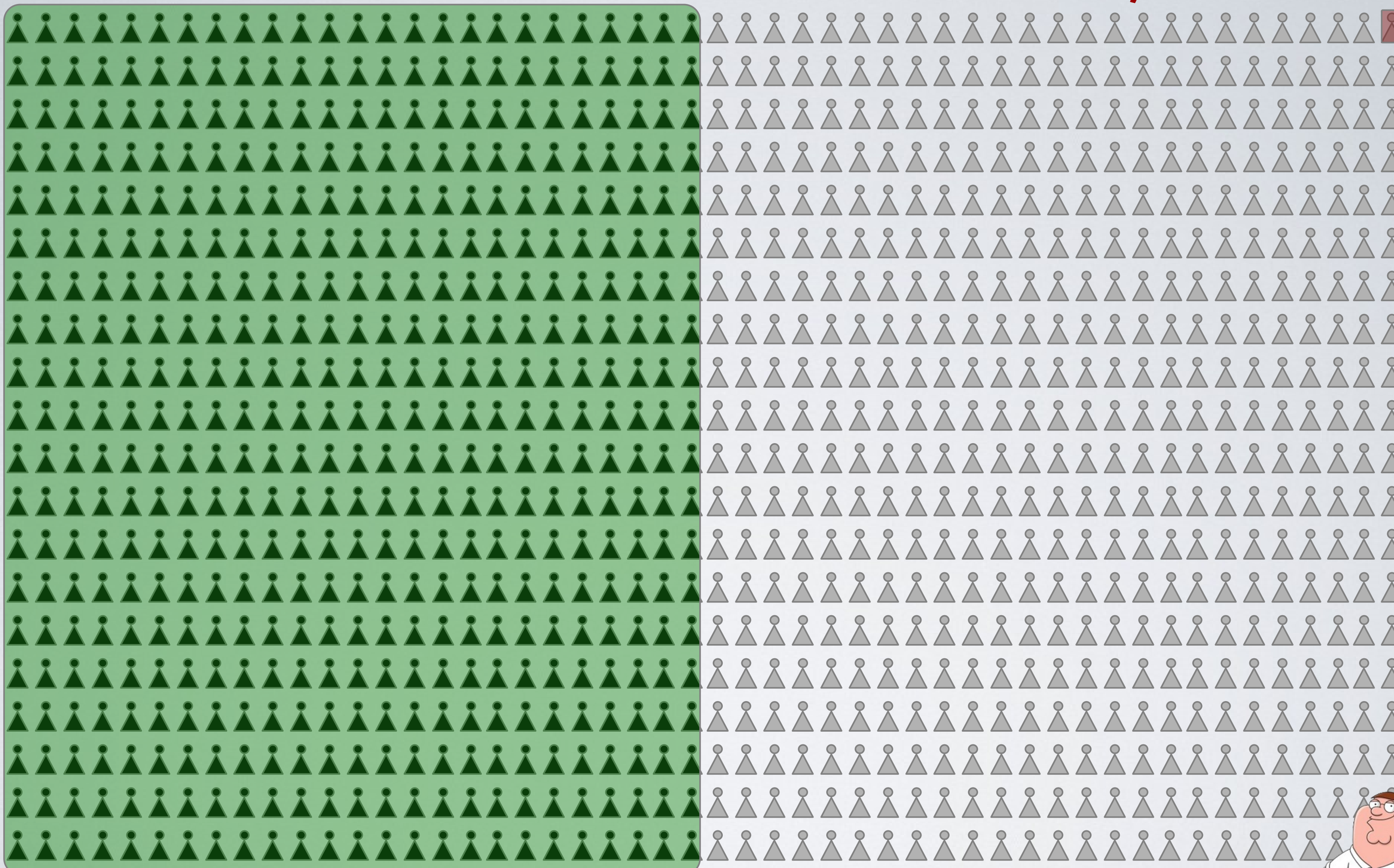
500 out of 1000

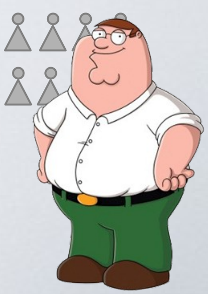


Hit rate **100%**

500 out of 1000

False positives **0,1%**





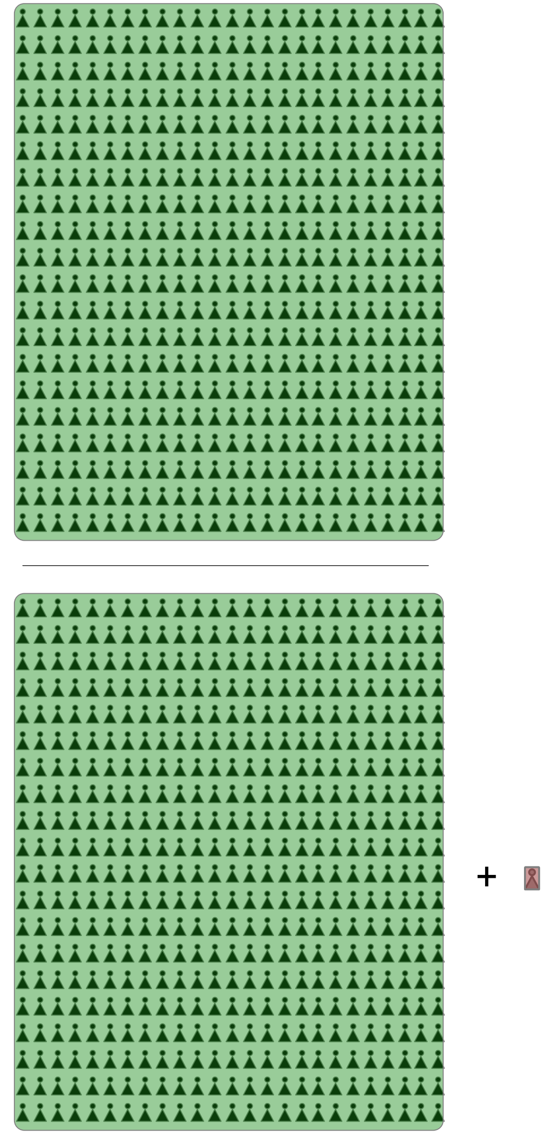
PPV = 99.8%

Hit rate **100%**

500 out of 1000

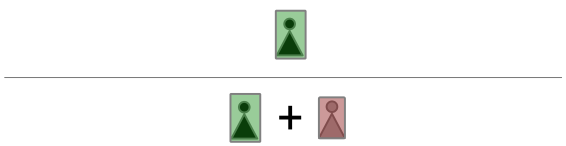
False positives
0,1%

$$\frac{\text{TRUE +}}{\text{TRUE +} \; + \; \text{FALSE +}} =$$



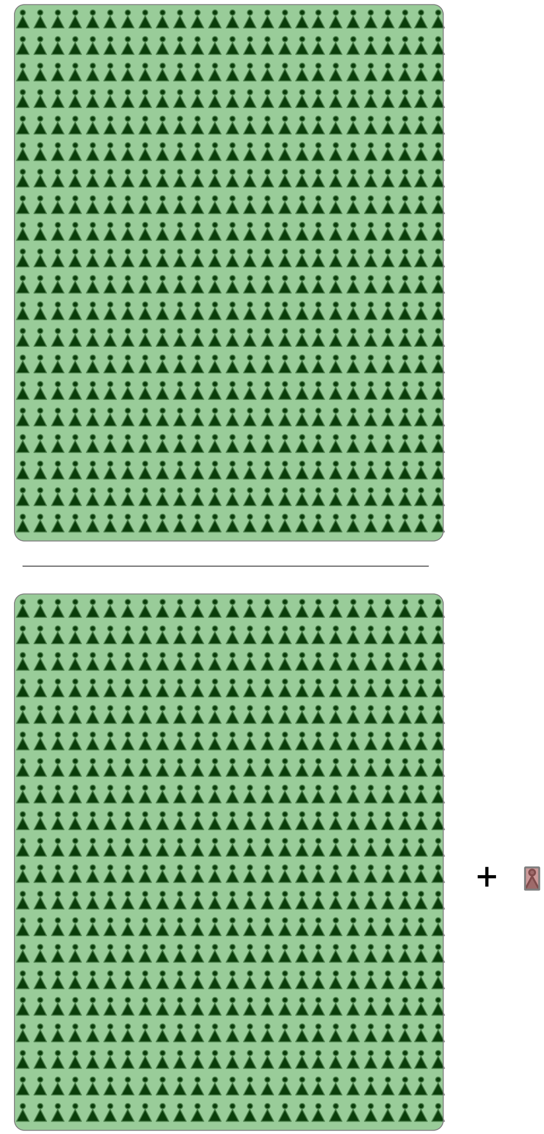
<u>Population A</u>

1 out of 1000



<u>Population B</u>

500 out of 1000



Adopt an Unicorn test, or they will go extinct!

Prevalence and

Positive Predictive Value

[Adopt an Unicorn edition]

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Presentation in:

https://github.com/gorkang/presentations

PPV or NPV depending on Sensitivity, Specificity and Prevalence:

https://gorkang.shinyapps.io/BayesianReasoning/

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