

Prevalence and Positive Predictive Value

[Adopt an Unicorn edition]

Gorka Navarrete



CSCN

CENTRO DE NEUROCIENCIA
SOCIAL Y COGNITIVA

ESCUELA DE PSICOLOGÍA · UAI

Gorka Navarrete

www.cscn.uai.cl

gorkang@gmail.com

@gorkang

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

$p(\text{Disease}|\text{+})?$

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

$p(\text{Disease}|\text{+})?$

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%

$$\frac{\text{TRUE} +}{\text{TRUE} + + \text{FALSE} +} = \frac{\text{[Green Person Icon]} + \text{[Green Person Icon]} + \text{[Red Person Icon]}}{\text{[Green Person Icon]} + \text{[Green Person Icon]} + \text{[Red Person Icon]}}$$



Hit rate **100%**

1 out of 1000

False positives
0,1%

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

PPV = 50%



Hit rate **100%**

1 out of 1000

False positives
0,1%

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

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%



Massive screening

Type 2 diabetes

Population B

500 out of 1000



Population B

Hit rate
100%

False
positives
0,1%

Prevalence
500 out of 1000

$p(\text{Disease}|\text{+})?$

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

$p(\text{Disease}|\text{+})?$

How much can I trust a + result?

<25%

25-49%

50%

51-75%

>75%

(99,8%)

500 out of 1000

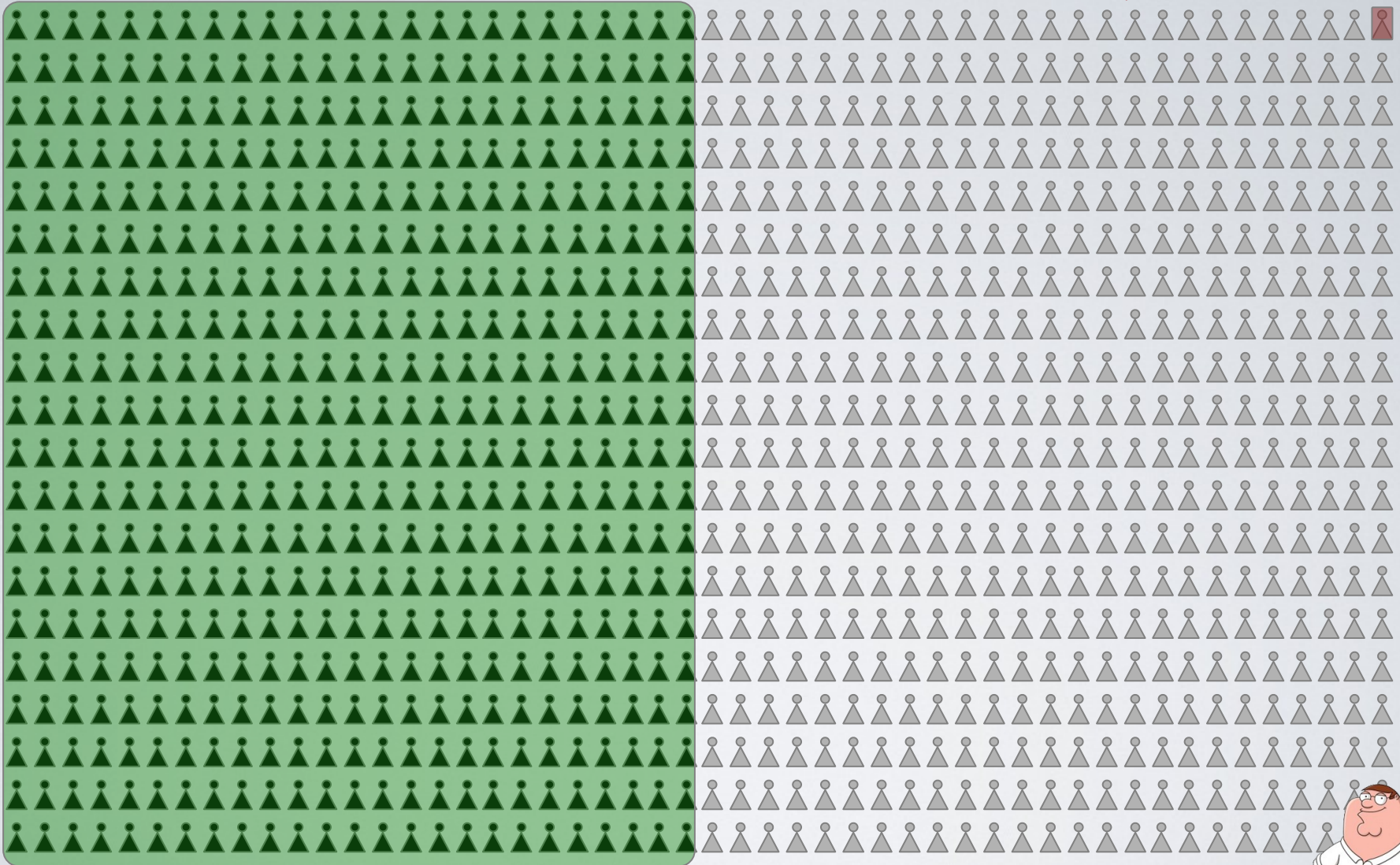


Hit rate **100%**

500 out of 1000

False positives

0,1%



PPV = 99.8%

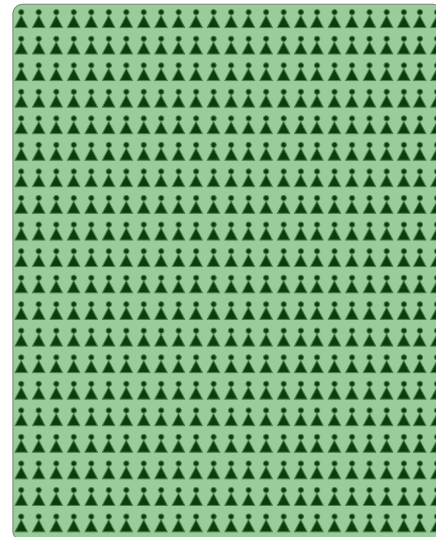
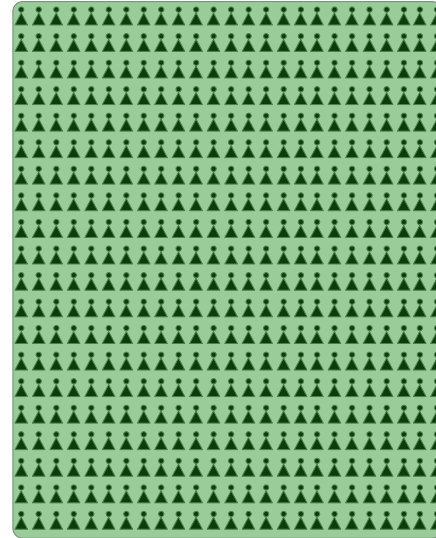


Hit rate **100%**

500 out of 1000

False positives
0,1%

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

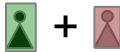


+



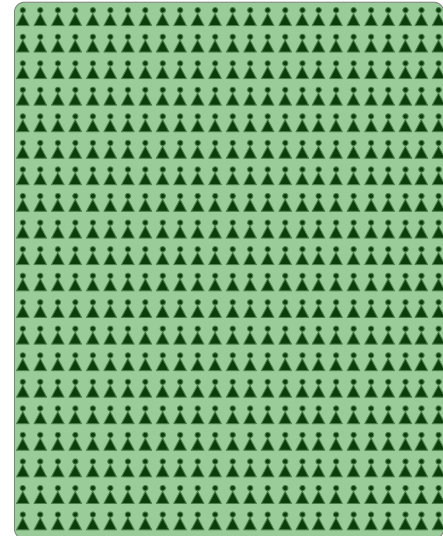
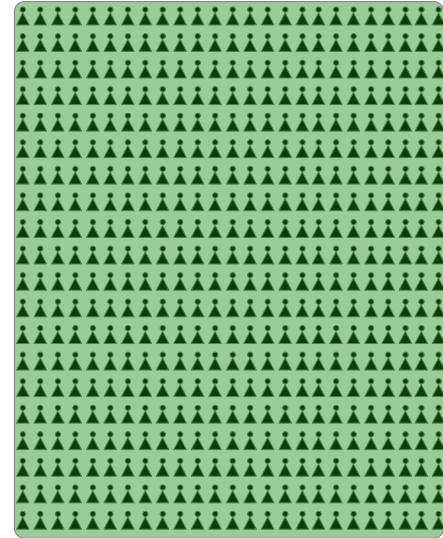
Population A

1 out of 1000



Population B

500 out of 1000



Adopt an Unicorn test, or they will go extinct!



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PPV or NPV depending on Sensitivity, Specificity and Prevalence:

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