

What is P-Value? Why do we use them?

Assume that we have 2 drugs, Drug-A ; Drug-B and want to know if Drug-A is different form Drug-B

so we tested it on two different people one gets Drug-A another one gets the Drug-B, we found that person with Drug-A was cured and the person with Drug-B isn't however we can't conclude that Drug-A is better than Drug-B.

There might me many reasons for Drug-B to be failed like the person might have some sort of allergies or he might have not used Drug-B correctly or may be he/she is undergoing some medication which isn't reacting well with Drug-B

similarly who knows Drug-A was the actual drug for cure, may be it worked due to placebo effect and Drug-A has nothing to do with this.

there can be a lot of things that can happen when doing this test for that reason lets test it on some more people and see.

Now we redo the experiment instead on one each lets try it on two each in other words two people gets Drug-A and two people will get Drug-B and result we see that both people with Drug-A got cured but one person with Drug-B was not cured where other person with Drug-B was cured

However we still can not say that Drug-A is better than Drug-B. may be that person having some kind of allergies that made Drug-B fail to cure on one person or may be the Drug-A was wrongly labeled as Drug-B and was given to other person and it cured

Lets redo the experiment again and now with lot of different people and assume the result somewhat like this...

	Cured	Not Cured
Drug-A	1043	3
Drug-B	2	1432

Drug-A Cured around 1043 people and didn't cured for only 3 people other words 99.7% people of 1046 were cured with Drug-A

other hand Drug-B cured only 2 people and didn't cured for 1432 people other words only 0.1% people of 1434 were cured with Drug-B

If these were the results then its pretty obvious that Drug-A was better than Drug-B,in other words it seems to be unrealitic to suppose that these results were just random chance and there is no difference in Drug-A and Drug-B

Its posible that Drug-A was successful to cure because of placebo effect and Drug-B wasn't successfull due to some allergies

what is these were the results

	Cured	Not Cured
Drug-A	73	125
Drug-B	59	131

Only 37% who took Drug-A were cured and 31% who took Drug-B were cured, clearly Drug-A cured higher % of people however there might be some random things that could be happened.

How confident are we that Drug-A is better than Drug-B? ans for this is **P-Value**

P-Value quantify how confident we could be....

closer the P-Value to 0 higher the confidence and closer the P-Value to 1 lesser the confidence

in general we use $p=0.05$ has the threshold which means after doing same experiment multiple times then only 5% would end up as wrong decision.

To make a clear understanding on the above statement lets take an example

Assume we gave the same drug Drug-A to 2 different groups

	Cured	Not Cured
Drug-A	73	125
Drug-B	71	127

Now any difference in the result is very obvious that there is some placebo effect on one person or allergies in another

In this case P-Value = 0.9 which is way larger than threshold (0.05)

if we repeat the same experiment lot of time we may get similarly large p value

thus we would say that we fail to see the difference between two groups

Now if we had results something like this then

	Cured	Not Cured
Drug-A	60	138
Drug-B	84	114

P-Value = 0.01 in this case we would say that two groups are different even though they took same drug Drug-A (Reasons : placebo,allergy)

- P-Value helps us decide if we should reject NULL HYPOTHESIS or Not
- Small P-Value helps us decide if Drug-A is Different from Drug-B, it doesn't tell us how different they are.