Mistakes

We all make them. Even statistical analysts

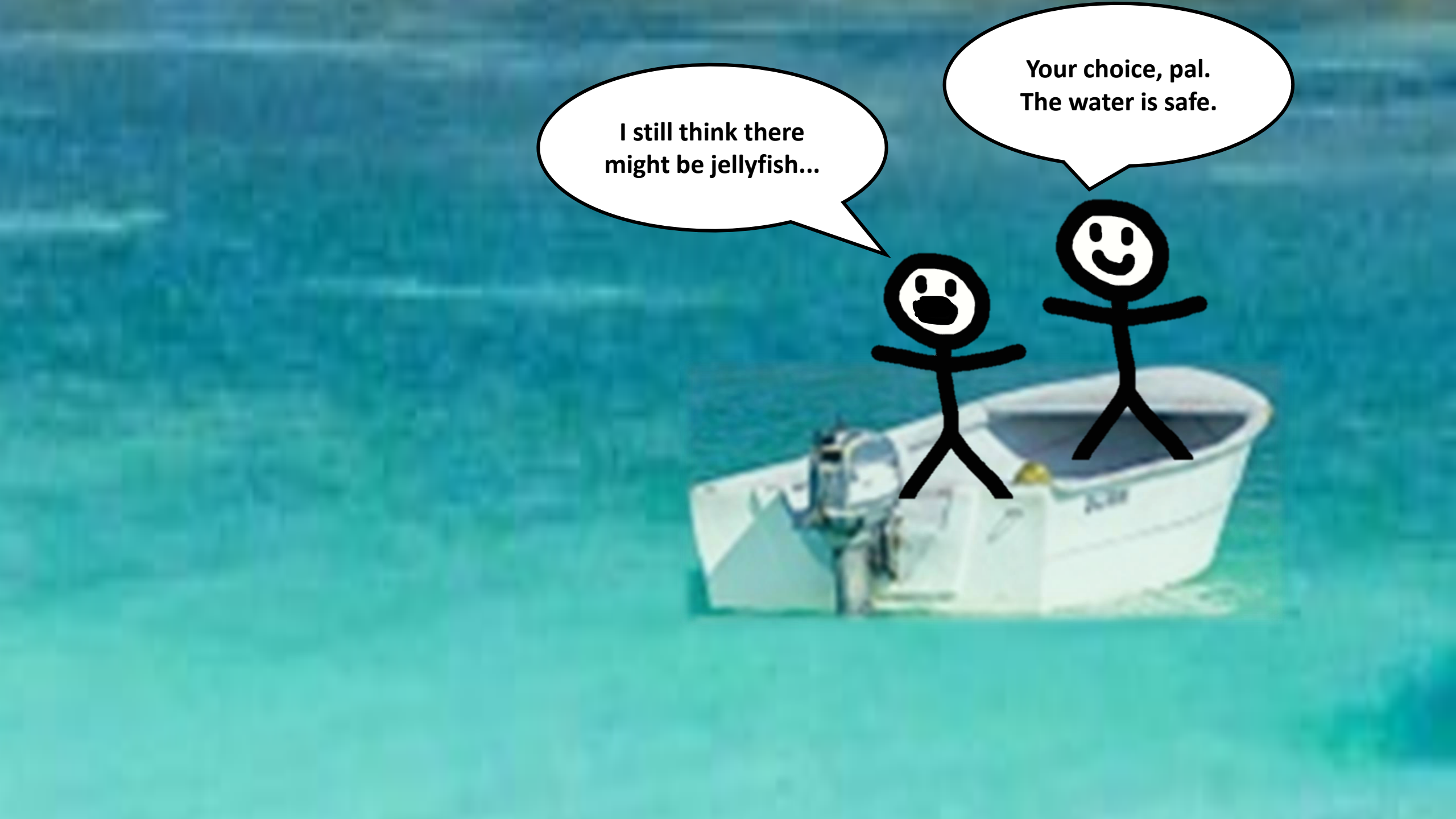
But first...Let’s go on a holiday!


No Jellyfish here!!
Jellyfish?

In the boat, we are forming a hypothesis and a null hypothesis

H0 = There are no jellyfish in the water. Going swimming will not lead to getting stung

H1= There will be jellyfish in the water. Going swimming may lead to getting stung.


I still think there might be jellyfish...
Your choice, pal. The water is safe.

Oh no...we made an error. A type 1 error

We rejected the null hypothesis when it was true! We could have gone swimming and been safe from the jelly fish.

P.S. Rejecting the null hypothesis when it is true means the same thing as accepting the Alternate hypothesis when it is false! Moving on...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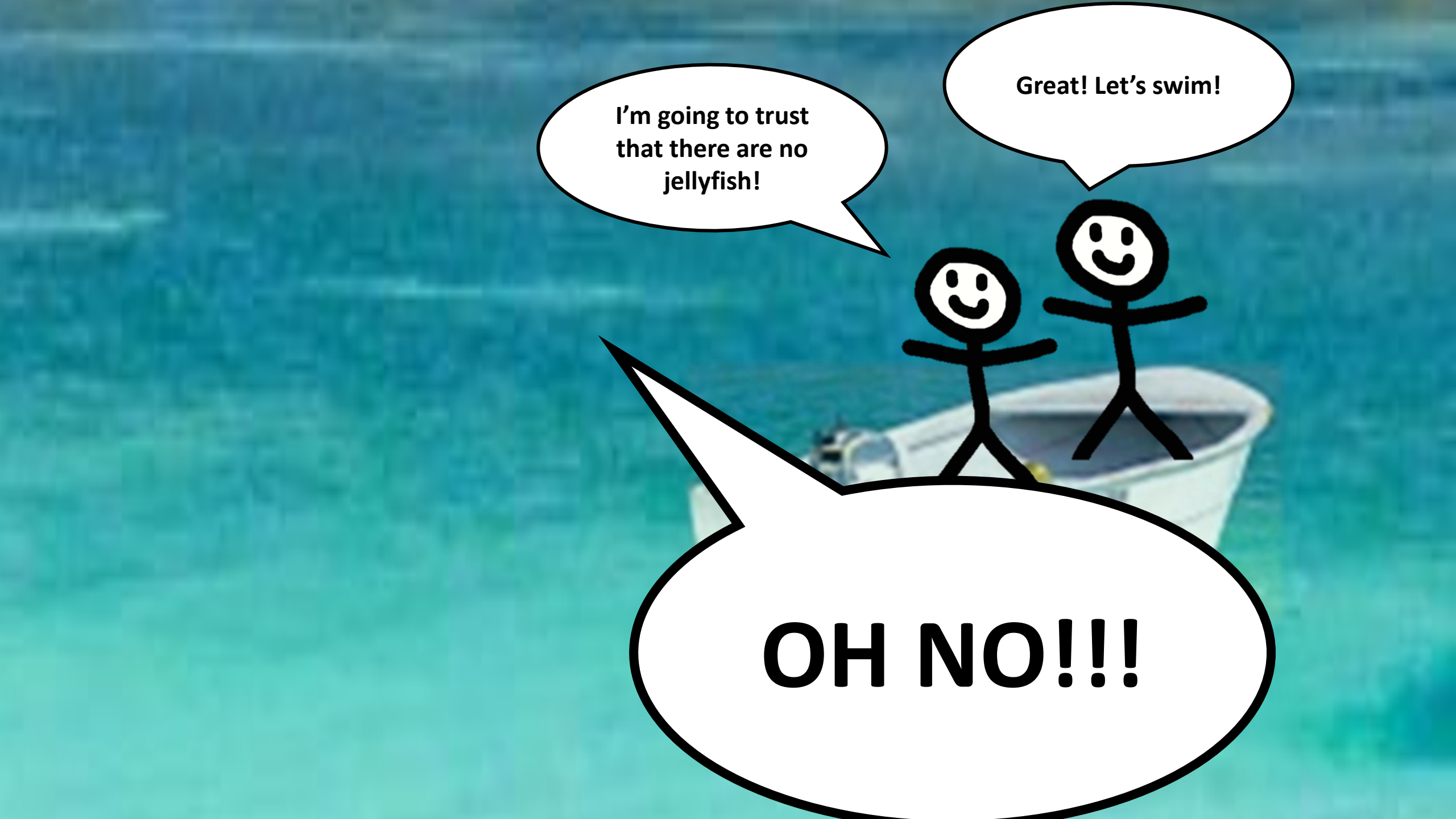
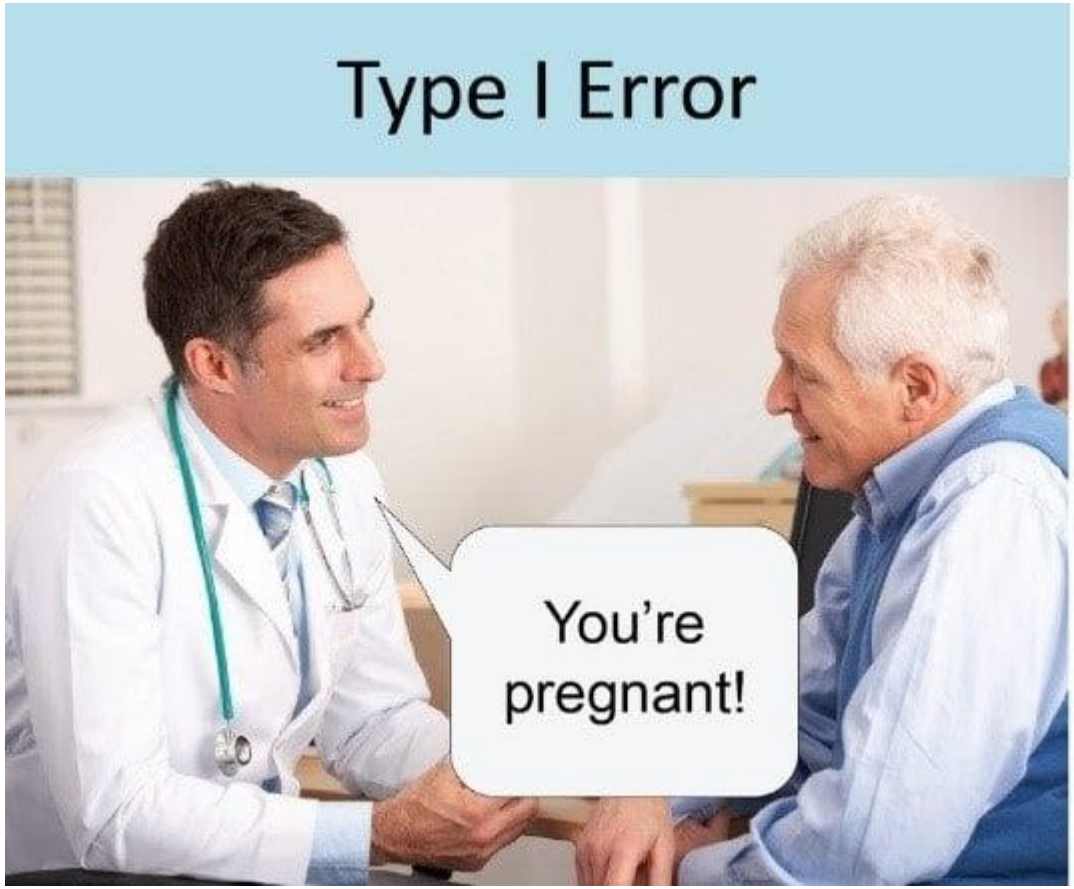
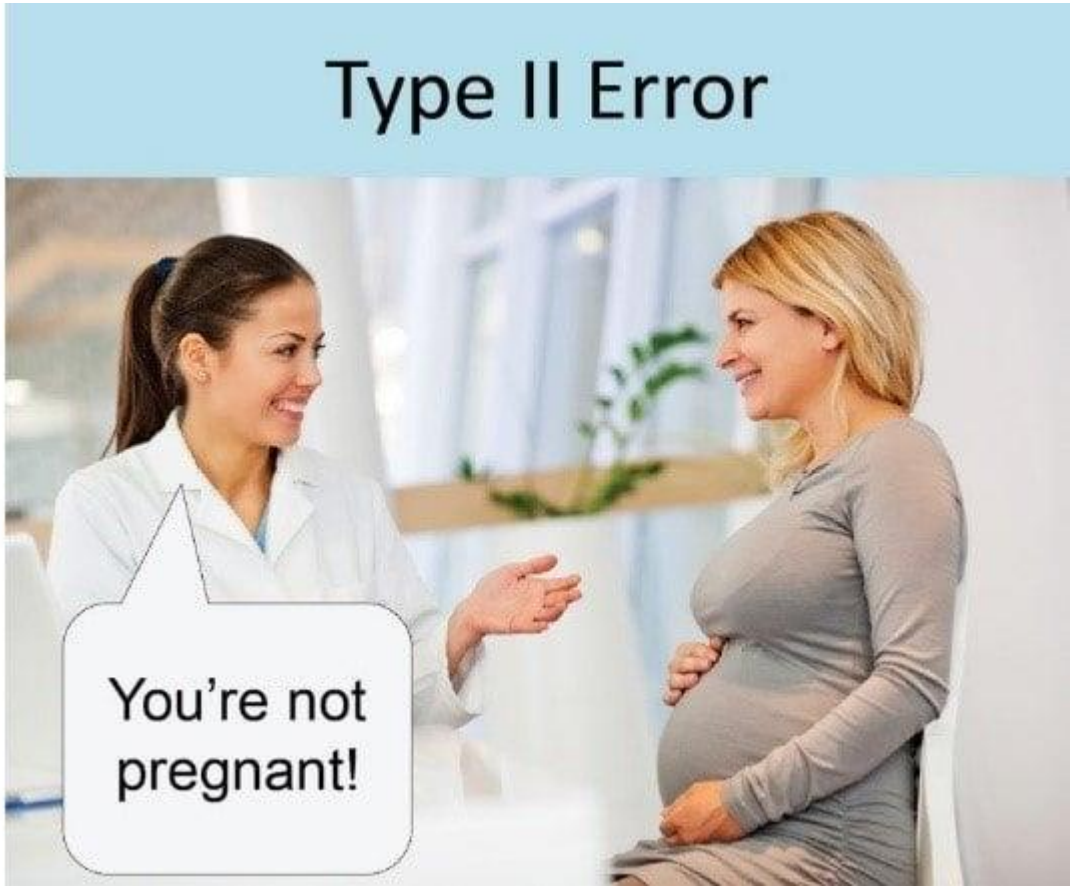

I’m going to trust that there are no jellyfish!
Great! Let’s swim!
OH NO!!!

Oh no...we made an error. A type 2 error

<u>We rejected the alternate hypothesis</u> when it was true! We went swimming and got stung! Ouch!

Side by side visualization





Let’s look at a HR example!

We need to improve the level of English in our company. Please ensure all new hires are competent in the language.

How can we do this?

You decide that the hiring process will now include a written English test

In the office, you are forming a hypothesis and a null hypothesis

H0 = The written test will have no impact on the selection of candidates with proficient English.

H1= The written test will have a positive impact on the selection candidates with proficient English

But then you conduct your interview in Dutch!

You end up with new hires who cannot speak English proficiently! Whoops!

A Type 1 error has occurred. We rejected our null hypothesis even though it was true!

H0 = The written test will have no impact on the selection of candidates with proficient English.

A **Type 1 error** is caused either by random chance or poor study design. It is a **FALSE POSITIVE**

In this case, the study design is the problem.

You decide to change tactics...

But only 3 people apply for the job. 2 fail the written English test, and 1 passes. You invite them all for an interview.

Well this job will be very hard given I don’t know what I am doing.

You’re asking for a very high salary when you have no experience...

All of the candidates speak English well at the interview...

My weakness is that I always speak my mind.

Please tell me some of your weaknesses.

And you end up hiring someone who failed the written test....

But it turns out that his English isn't as good as it appeared in the interview, especially when it comes to paperwork.

A type 2 error has occurred! We rejected our alternate hypothesis even though it was true!

H1= The written test will have a positive impact for selecting candidates with proficient English

A **Type 2 error** is caused by not enough statistical power (replicates, candidates, sample size etc). It is a **FALSE NEGATIVE**

We needed more candidates than 3 in order to validate this hypothesis

To summarize

There are two kinds of Errors: Type 1 and Type 2

<u>Type 1 is a FALSE POSITIVE.</u>

A researcher accepts H1 when they should have accepted H0.

Something that is not significant is reported to be significant

<u>Type 2 is a FALSE NEGATIVE</u>

A researcher accepts H0 when they should have accepted H1.

Something that is actually significant is not reported