Experimental Design

What do you want to test? (explore and define the topic)

What is your hypothesis? (formulate a specific question to which you want to know the answer)

How does this fit into what you and others already know?

Independent and dependent variables: what are you going to change deliberately, and what are you going to measure? ONE INDEPENDENT VARIABLE AT A TIME FOR CLARITY

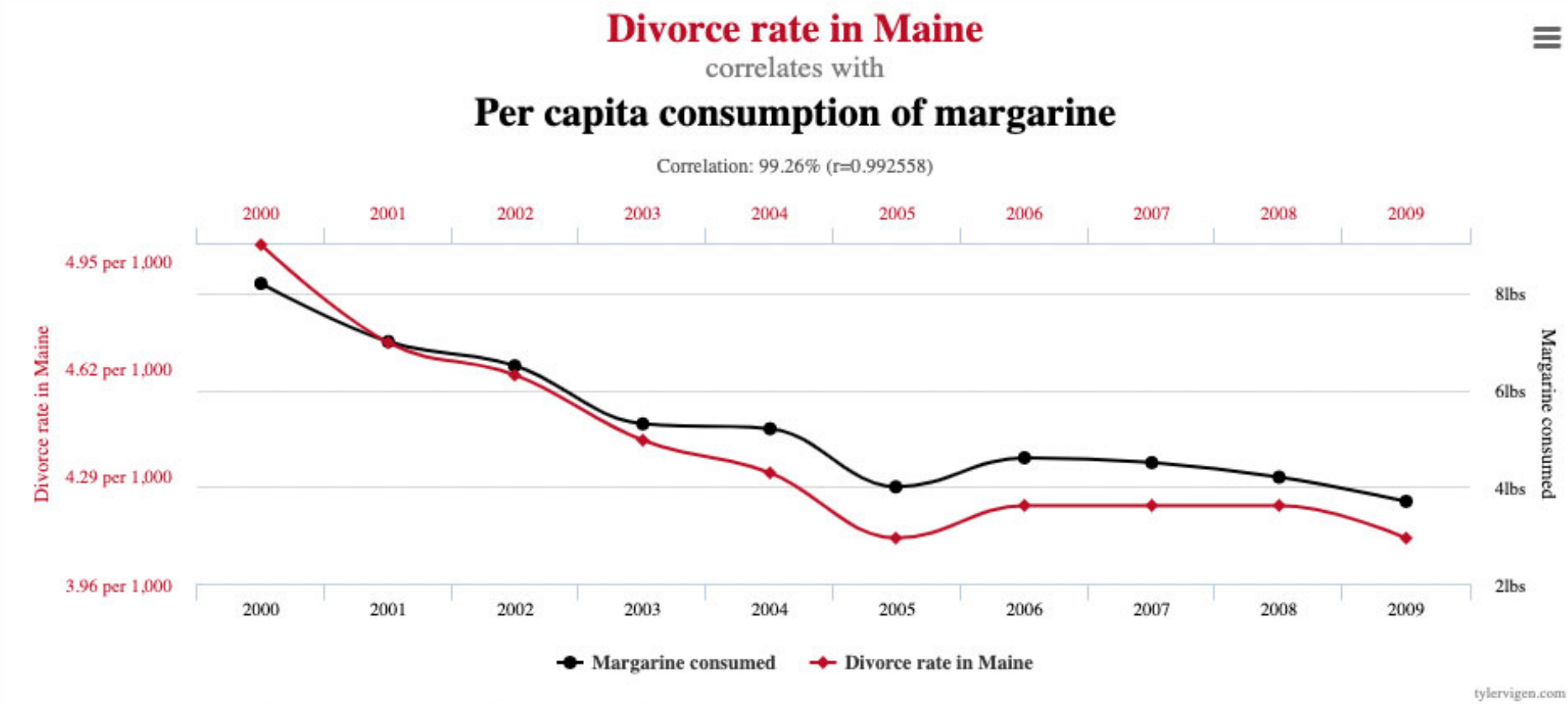
What are you going to hold constant? How are you going to hold it constant?

How are you going to do it?

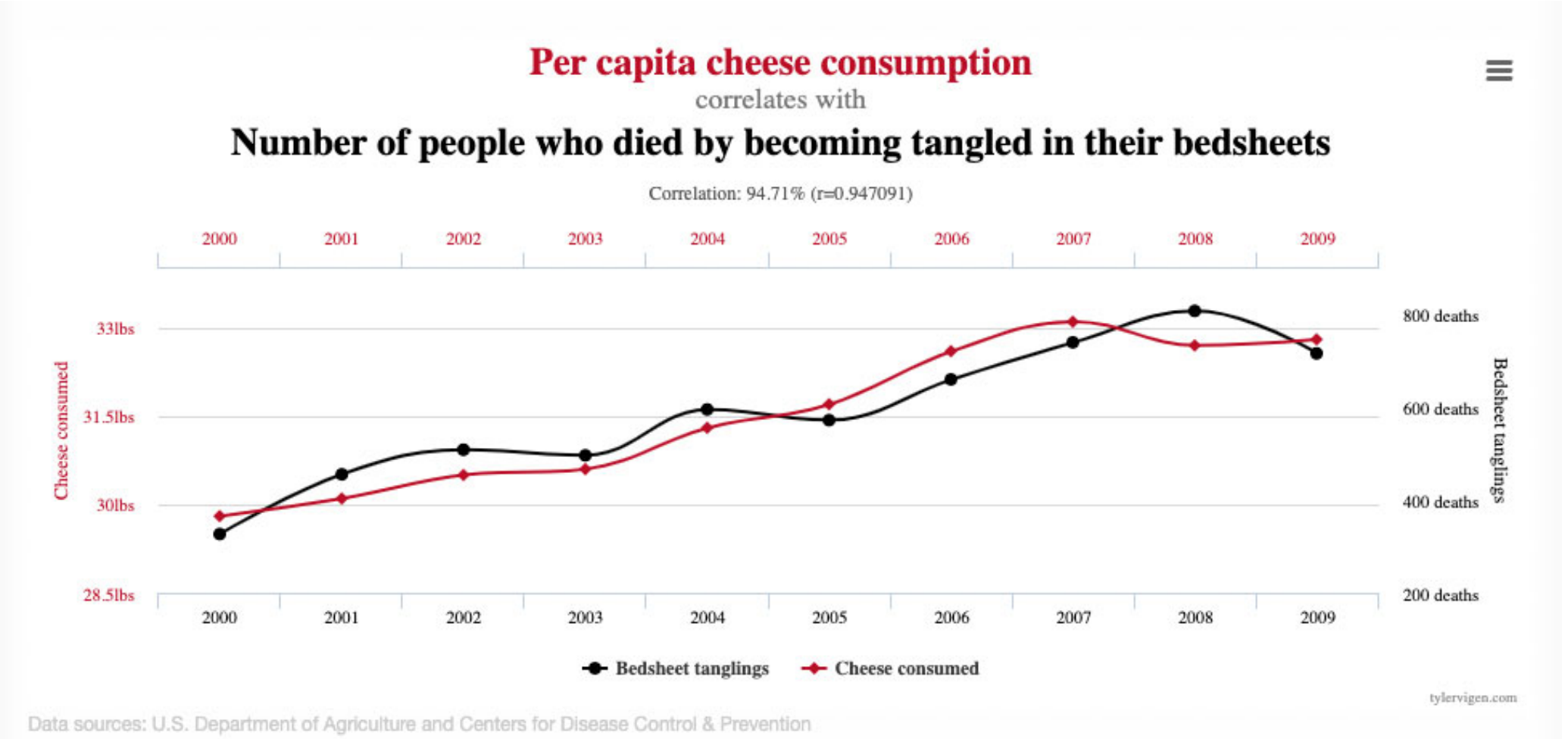
*experiment should be repeatable (by you and by others)
*feasible in the time and $$ you have available?
*should produce results that will test your hypothesis!

Is this even a good idea? (ethical implications)

Pitfalls in conducting an experiment?
*method introduces too much error to test what you wanted to?
*unintended variables not held constant (environment)
*confirmation bias: give your data room to tell their actual story, not the one you expected them to tell!
*correlation vs. causation (overinterpreting? P-hacking?)

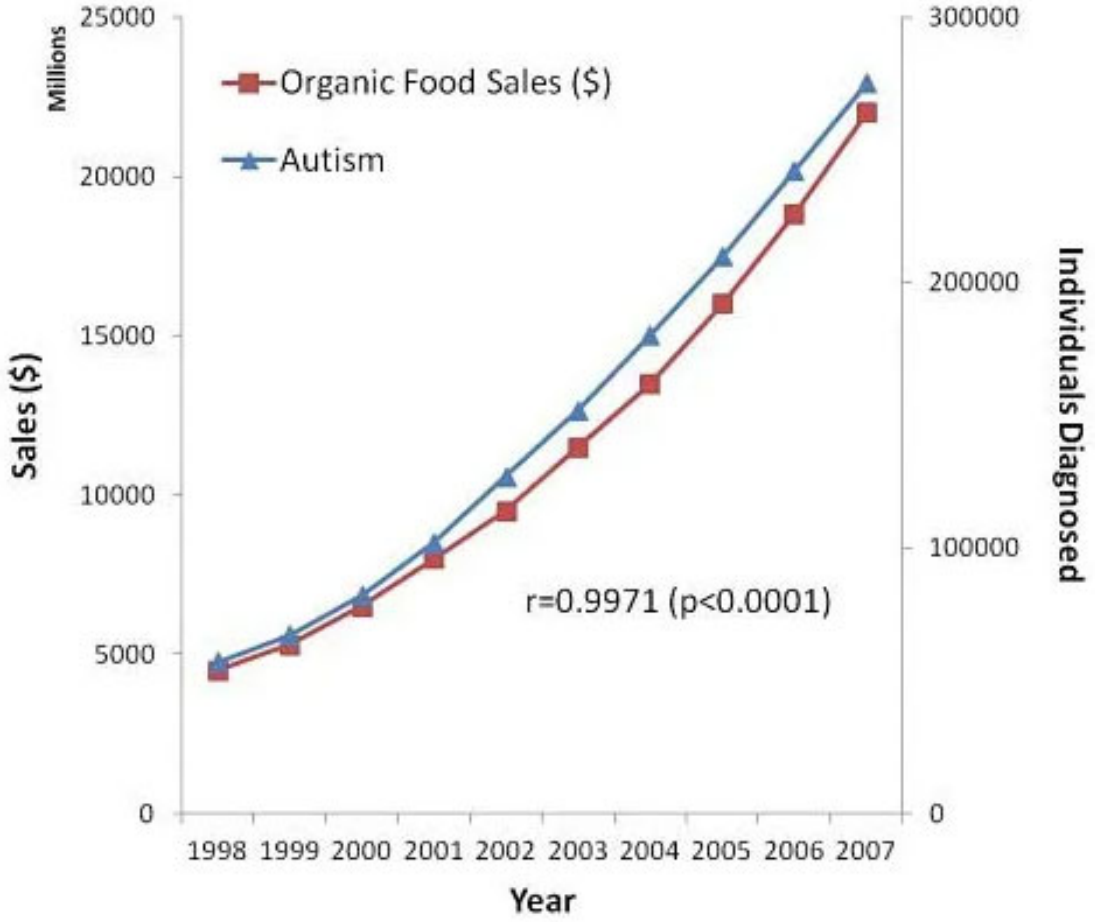


Data sources: National Vital Statistics Reports and U.S. Department of Agriculture



These examples come from someone who wrote a script to harvest data from a bunch of publicly accessible databases and plot a bunch of things against each other until something (accidentally) correlated strongly! ("p-hacking")

More fun correlations: https://www.tylervigen.com/spurious-correlations



This one is maybe not so funny – what do you do with correlations like this?

A correlation is the beginning of the study, not the end! If you see a correlation, can you design a follow-up study to test whether there is causation or not? Can you come up with any logical reasons for a causal relationship?

This correlation, for example, has very robust theory logic confirming that it is causal. Also many controlled experiments on a much-smaller-than-planetary scale and some comparative planetary studies.