

The logic of experimental design assignment



The randomized comparative experiment is one of the most important ideas in statistics. It is designed to allow us to draw cause-and-effect conclusions. Be sure you understand the logic: Randomization produces groups of subjects that should be similar in all respects before we apply the treatments. Comparative design ensures that influences other than the experimental treatments operate equally on all groups. Therefore, differences in the response variable must be due to the effects of the treatments.

We use chance to choose the groups in order to eliminate any systematic bias in assigning the subjects to groups. For example, sickle-cell anemia is an inherited disorder of the red blood cells that in the United States affects mostly blacks. It can cause severe pain and many complications. For example, a doctor might subconsciously assign the most seriously ill patients to the hydroxide group, hoping that the untested drug will help them. That would blast the experiment against hydroxide. Choosing a Simple Random Sample (SIRS) of the subjects in one

group gives everyone the same chance to be in either group. We expect the two groups to be similar in all respects age, seriousness of illness, smoker or not, and so on. Chance tends to assign equal numbers of smokers to both groups, for example, even if we don't know which subjects are smokers. It should not surprise you to learn that medical researchers adopted randomized comparative experiments only slowly? many doctors think they can tell "just by watching" whether a new therapy helps their patients. Not so.

There are many examples of medical treatments that became popular on the basis of one-track experiments and were shown to be worth no more than a placebo when some skeptic tried a randomized comparative experiment.

One search of the medical literature looked for therapies studied both by proper comparative trials and by trials with “ historical controls. ” A study with historical controls compares the results of a new treatment; not with a control group, but with how well similar patients had done in the past.

There is no such requirement for other medical treatments, such as surgery.

A Google search of “ comparisons with historical controls” found recent studies for other medical treatments that have used historical controls.

There is one important caution about randomized experiments. Like random samples, they are subject to the laws of chance. Just as an SIRS of voters might by bad luck choose people nearly all of whom have the same political party preference, a random assignment of subjects might by bad luck put nearly all the smokers in one group.