Statistics in clinical trials: Sample populations

Introduction

Statistical methods provide formal accounting for sources of variability in patients' responses to treatment. The use of statistics allows the clinical researcher to form reasonable and accurate inferences from collected information, and sound decisions in the presence of uncertainty. Statistics are key to preventing errors and biases in medical research. This article covers the selection of sample populations for clinical trials.

Sample populations

In a clinical trial, the objective is to get information about the effect of a treatment in a certain patient population. Obviously researchers can't administer a treatment to the whole population, which wouldn't ethically or financially be viable, so a clinical trial selects a sample from the patient populations.

Sample size calculation is the act of determining the appropriate number of patients to include in a clinical trial. Once again, obviously the more patients that are on a trial the more reliable the conclusions will be, however, larger studies need more resources (in terms of finance and patient commitment) and they could increase the number of patients being exposed to potentially inefficient or even dangerous treatment.

So assuming a trial is conducted, from the observed effects in a sample what can we say about the treatment effect in the population? This is where 'statistical inference' comes in;

more specifically, through the concept of hypothesis testing.

What drives sample size calculation?

- **The design of the clinical trial** – different phases of trials have different requirements, and will adjust their sample sizes accordingly.
- **The choice of primary endpoint(s)** – primary endpoints being the main result(s) that is studied at the end of a study to see if the treatment worked.
- **The research hypotheses** – the magnitude of the targeted treatment effect in the 'alternative hypothesis' – the strength of the effect, for want of a better phrase – is critical. The sample size decreases as the expected effect increases. In this sense, the new treatment effect should be large enough to be medically worthwhile in order to convince the medical community that it should be adopted in spite of additional costs and side effects etc.
- **Type I and Type II error rate** – you might imagine that the Type I error rate would always have to be much lower than the Type II error rate. That is certainly true of Phase III clinical trials. In Phase II trials, however, the risk of missing an effective medicine is considered to be more problematic at this point of the medicines development process.
- **Resources** – patient availability and financial constraints may limit the sample size of a clinical trial.