# Overview: Multi-Arm Multi-Stage Trials

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In clinical trials there is a need to come up with more efficient trial designs, because bringing new treatments to market is a long and expensive process. One such method is Multi-Arm Multi-Stage trials (MAMS) which aim to increase efficiency.

In a classical design for clinical trials a single experimental treatment is tested in comparison against a control treatment for a set number of patients. Then they test to see if there is enough evidence to say that the new treatment is better or not. If there is not enough evidence then that treatment is discarded and all the time and money that went into designing and testing it is wasted. In clinical trials, there are two types of control treatment:

1. Placebo - a fake version of the experimental treatment which in appearance is the same as the experimental treatment.
2. Active - the current standard treatment for the disease you are testing.

Depending on the experimental treatment and the disease we are studying, we decide which type of control to use.

The "Multi-Arm" part of a Multi-Arm Multi-Stage trial comes from us having several experimental treatments which are tested simultaneously against a common control. This results in needing less control patients as compared to running multiple separate single arm trials. We can do a direct comparison between each treatment which reduces bias, compared to comparisons of treatments which have been tested in separate trials.

The "Multi-Stage" part of a Multi-Arm Multi-Stage trial comes from us conducting interim analyses on our treatments. After conducting these interim analyses we then decide which experimental treatments we should continue with, or if there is enough evidence that a treatment is superior so we can stop and choose this treatment. This results in us having a lower potential number of patients and potentially reducing the time the trial takes.

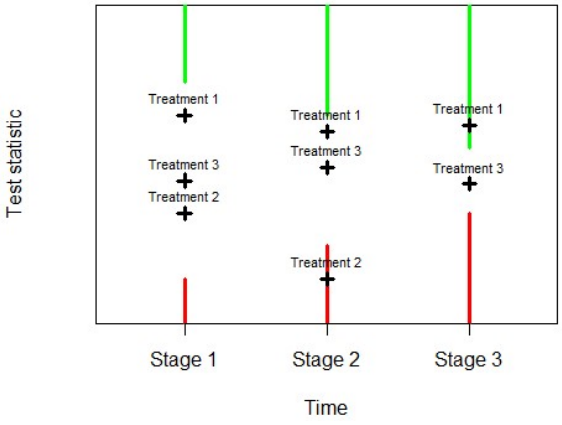


Figure 1: An example of how MAMS trials work.

In figure 1 we have given an example of how a Multi-Arm Multi-Stage trial works. As you can see we will drop treatment 2 at stage 2 as there is evidence that it is not going to have a clinically relevant improvement compared to the control, so there is no point in spending more money investigating this treatment. At stage 3 we find that there is enough evidence that treatment 1 is superior therefore we can stop the trial here. Normally in clinical trials we are only after one new treatment therefore, we will also drop treatment 3.

In our report we study how currently we are under estimating the sample size needed for a Multi-Arm Multi-Stage trial. We begin our report by discussing the types of errors we need to control when making our sample calculation. Then move to our main focus of looking into the effects of different factors on the minimum patient numbers needed. We show how the rate at which we recruit patients; the length of time it takes before we can measure the treatments effect; and the length of time it takes to conduct the analysis, can all have huge impacts on the minimum patient numbers.