

Title: Information content of cluster-period cells in stepped wedge trials

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Stepped wedge trials are a particular variant of multiple-period cluster randomised trials, being used with increasing frequency in health research. Instead of being randomised to one of (usually) two treatments as in parallel cluster randomised trials, in SWs the clusters are randomised to particular sequences of treatments. In a standard stepped wedge trial, all clusters initially implement the control condition before eventually implementing the new intervention, with an equal number of clusters switching to the new intervention at regularly-spaced time points. These trials are often expensive to implement, and require that data be collected from each of K clusters at T time periods. To reduce the costs associated with the implementation of the trial it may be desirable to restrict the total number of cluster-period cells in which data is collected. Although some designs with missing cells have been proposed, such as the so-called dog-leg design, there are no general guidelines regarding which cells of a stepped wedge design contain the most information about the treatment effect, and correspondingly which may be omitted with a minimum loss of information.

We consider the information content of the cluster-period cells and the clusters of the standard stepped wedge design, where the information content of a cell is quantified by the increase in the variance of the treatment effect when that cell is omitted. The variance of the treatment effect will never decrease whenever a cell is omitted, and the smaller the increase in variance, the less information about the treatment effect a cell is said to contain. We show that the most information-rich cells are those that occur immediately before or after treatment switches, but there are also additional cells that contribute almost as much to the estimation of the treatment effect. We also show that the information content patterns depend on this correlation structure.