

Meta-analysis - methodology

A meta-analysis was undertaken to assess the impact of probation supervision on recidivism. The meta-analysis included a set of articles which were extracted from peer reviewed academic journals and which met the inclusion criteria. We noted considerable variation between the studies, in terms of the:

1. *Definition of the dependent variable*, which was not consistent across studies. Some studies measured the effects of the intervention on re-arrest, whilst others measured reconviction. Moreover, whilst some papers include technical violations of probation, other do not.
2. *Length of time at which reoffending is measured*, which varies across the studies between 12 and 36 months (with the exception of one study, which measures reoffending at up to 52 months, with an average of 35 months).
3. *Treatment* (i.e. the particular type of supervision program). Some programs targeted probation officers while others focused on offenders. There are instances in which a study assesses the impact of two different interventions, and in those cases the results pertaining to both programs are included in the meta-analysis.

When a study defined the dependent variable by including several outcome measures (e.g. reconviction, rearrest, technical violation) and/or measured reoffending at multiple time periods, we chose to include the most inclusive outcome and timeframe which would potentially capture the greatest amount of reoffending.

Types of study

We identified two types of study, depending on the measurement scale of the dependent variable:

Binary dependent variable

Studies with a binary dependent variable measure the proportion of participants that reoffended in the treatment group compared to the proportion of participants that reoffended in the control group (or matched comparison group) at a defined point in time. Typically, papers in this group are based on experimental or quasi-experimental designs (with matched comparison groups).

Continuous dependent variable

Studies with a continuous dependent variable consider survival rates pertaining to reoffending at different points in time, and report outputs as hazard ratios.

Data extraction, analysis and forest plot generation

We reviewed each article and extracted relevant information about sample size, proportions of success or failure (i.e. reoffending) by experimental condition, effect size and its variance. Due to the differences between the dependent variables used by the two types of studies, we implemented two meta analyses, one for each category of papers. Both analyses were implemented using the *metan* package in Stata.

Studies with a binary dependent variable

Most papers in this category employ significance testing of the differences in proportion between experimental groups, and a small number of papers employ more elaborate methodologies (for example by implementing controlled regressions such as logistic regression). However for all papers in this category we include the simple differences in proportion between groups.

For studies in this category we computed the number of participants in each of the four cells of a matrix defined by experimental condition (treatment/control) and outcome (reoffending/not reoffending). Based on these numbers we computed the odds ratios of reoffending in the treatment group compared with the control group. We also computed the 95% confidence interval associated with the odds ratio. These values are displayed on the forest plot.

In the next step, we used the effects identified for each study to generate an **overall effect size**. We used two models:

- Fixed effects using the Mantel–Haenszel weighting method. The fixed effects model assumes that the effects we observe in the relevant studies are estimates of a single ‘real’ treatment effect.
- Random effects using the DerSimonian and Laird method. This method assumes that the treatment effects observed in the relevant studies are a random sample from a distribution of treatment effects.

Both methods use a weighting scheme by which studies with a larger sample size are given a higher weight in the overall effect size. The weights are displayed in a column on the forest plot.

The forest plot includes the overall effects (and their variances) computed under both fixed and random effects.

Studies with a continuous dependent variable

A second meta-analysis was performed on this group of studies. We extracted the reported hazard ratios (and their confidence intervals) of reoffending at 24 months (or as close to this as possible). Stata was used to analyze the hazard ratios extracted from each paper along with the lower and upper bounds of their 95% confidence intervals, and to calculate an effect size. Using these calculated effect sizes we once again calculated:

- Fixed effects using the Mantel–Haenszel weighting method.
- Random effects using the DerSimonian and Laird method.

As with the binary meta-analysis, the forest plot displays the fixed and random effect estimates.