Forest plots

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Few systematic reviews containing meta-analyses are complete without a forest plot. But what are forest plots, and where did they come from?

What is a forest plot?
In a typical forest plot, the results of component studies are shown as squares centred on the point estimate of the result of each study. A horizontal line runs through the square to show its confidence interval—usually, but not always, a 95% confidence interval. The overall estimate from the meta-analysis and its confidence interval are put at the bottom, represented as a diamond. The centre of the diamond represents the pooled point estimate, and its horizontal tips represent the confidence interval. Significance is achieved at the set level if the diamond is clear of the line of no effect.

The plot allows readers to see the information from the individual studies that went into the meta-analysis at a glance. It provides a simple visual representation of the amount of variation between the results of the studies, as well as an estimate of the overall result of all the studies together. Forest plots increasingly feature in medical journals, and the growth of the Cochrane Collaboration has seen the publication of thousands in recent years.

Summary points
Forest plots show the information from the individual studies that went into the meta-analysis at a glance

- They show the amount of variation between the studies and an estimate of the overall result
- Forest plots, in various forms, have been published for about 20 years
- During this time, they have been improved, but it is still not easy to draw them in most standard computer packages

History
The origin of forest plots goes back at least to the 1970s. Freiman et al displayed the results of several studies with horizontal lines showing the confidence interval for each study and a mark to show the point estimate. This study was not a meta-analysis, and the results of the individual studies were therefore not combined into an overall result. In 1982, Lewis and Ellis produced a similar plot but this time for a meta-analysis, and they put the overall effect on the bottom of the plot (fig 1). However, smaller studies, with less precise estimates of effect, had larger confidence intervals and, perversely, were the most noticeable on the plots.

Means of focusing attention on the larger, more precise, studies were sought. Replacement of the mark with a square whose size was proportional to the precision of the estimate may have been first suggested by Stephen Evans at a Royal Statistical Society medical section meeting at the London School of Hygiene and Tropical Medicine in 1983. He based the idea on modified box plots. Ideas such as radial plots were also proposed. The first meta-analyses to include squares of different sizes to show the positions of the point estimates were probably those produced by the Clinical Trials Service Unit in Oxford in the 1998 overview of the prevention of vascular disease by antiplatelet therapy. The area of each square was proportional to the weight that the individual study contributed to the meta-analysis.

Fig 1 First use of forest plot for meta-analysis of effect of β blockers on mortality (reproduced with permission from Physicians World/Thomson Healthcare, Secaucus, NJ)
A memorable patient
A chandelier and a vat of custard

It was a busy Friday night in casualty. We were one senior house officer down and there had been a major accident on a nearby main road. All of us had been looking after seriously injured patients for the preceding couple of hours—not all of them had survived, and emotions were running high. During that time, the backlog of minor injuries had built up to a six hour wait, and tempers were fraying in the waiting room. The nurses were fielding angry patients, often with trivial injuries, and were desperate for one of us to come and help.

I returned to the minor side to start clearing the backlog as soon as possible. I was in a super-efficient and slightly short-tempered mood—didn’t they realise that we had to deal with major trauma? I picked the next card out of the box and went to the cubicle.

With barely a glance at the patient I said brusquely, “Well, what’s the matter then?” A middle aged man looked back at me impatient. He changed my perspective, brightened up my short-tempered mood—didn’t they realise that we had to deal with major trauma? I picked the next card out of the box and went to the cubicle.

With barely a glance at the patient I said brusquely, “Well, what’s the matter then?” A middle aged man looked back at me impatient. He changed my perspective, brightened up my short-tempered mood—didn’t they realise that we had to deal with major trauma? I picked the next card out of the box and went to the cubicle.

With barely a glance at the patient I said brusquely, “Well, what’s the matter then?” A middle aged man looked back at me and said, in a nonchalant tone, “I was preparing for my usual Friday night sexual activity when the chandelier broke, and I fell into the vat of custard.”

It took a second or two for me to realise what he’d said. I looked up at him in disbelief. “Really?” I asked. “No,” he said, “but I’ve been sitting in the waiting room for two hours trying to pluck up the courage to say that.”

As a grin broke over my face, I asked what had really happened, and he told me what he had done. As I treated him, I relaxed and chatted to him as a real person, not a patient.

I spent the rest of the shift milking. It inspired me to think that someone faced with a long wait had thought up something like that, and kept it in his mind, without getting annoyed or impatient. He changed my perspective, brightened up my short-tempered mood—didn’t they realise that we had to deal with major trauma? I picked the next card out of the box and went to the cubicle.

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