INFORMATION POINT:

Latin square

A Latin square is used in experimental designs in which one wishes to compare treatments and to control for two other known sources of variation. To use a Latin square for an experiment comparing n treatments we will need to have n levels for each of the two sources of variation for which we wish to control.

Latin squares were first used in agricultural experiments. It was recognized that within a field there would be fertility trends running both across the field and up and down the field. So in an experiment to test, say, four different fertilisers, A, B, C and D, the field would divided into four horizontal strips and four vertical strips, thus producing 16 smaller plots. A Latin square design will give a random allocation of fertiliser type to a plot in such a way that each fertiliser type is used once in each horizontal strip (row) and once in each vertical strip (column). Such a layout is shown in Fig. 1.

Column variable

	1	2	3	4
1	B	C	A	D
2	A	B	D	C
3	C	D	B	A
4	D	A	C	B

Fig 1. A Latin square design for four treatments.

In a cross-over trial we wish to test each treatment with each subject because we know there will be variability between patients. So each patient is like a row in the field. It may be that the order in which the patients try the treatments is important. If we simply randomize, for each patient, the order in which they try the treatments then we may find that there are no patients who use a particular treatment first. This would make it impossible to investigate the order effect. To try and overcome this, Armitage & Berry (1987) suggested the use of Latin square designs in cross-over trials.

In the study by Clarke-O'Neill *et al.* (2002) they are investigating 10 products (treatments) and each patient will try each product. To use a Latin square design we take 10 patients as the rows of the Latin square and the order position as the columns of the Latin square. So amongst the 10 patients we know that each will try every product once in some order and that every product will be tried first by one patient, secondly by one patient and so on. The next 10 patients are part of another Latin square, and so on. Senn (1993) provides a more complete discussion of the benefits of using this approach to the design of cross-over studies, and how to use and analyze such designs.

Further reading

Armitage P. & Berry G. (1987) ***Statistical Methods in Medical Research***, 2nd edn. Blackwell, Oxford.

Clarke-O'Neill S., Pettersson L., Fader M., Dean G., Brooks R. & Cottenden A. (2002) A multi-centre comparative evaluation: washable pants with an integral pad for light incontinence, ***Journal of Clinical Nursing*** **11**, 79–89.

Senn S. (1993) *Cross-Over Trials in Clinical Research*. John Wiley and Sons, Chichester.

NICOLA CRICHTON