# Graphical Presentation of Data

Zonal Health Information Committee
Central Zone Public Health Unit
Public Health Services
Queensland Health
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Tufte (1983) points out that 'graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space'. He goes on to say that 'graphical excellence is the well-designed presentation of interesting data - a matter of substance, of statistics, and of design...and consists of complex ideas communicated with clarity, precision, and efficiency'. The *Style Manual for Authors, Editors and Printers* (1994) emphasises that the role of graphs is to illuminate rather than to decorate and they should be 'clear, simple, uncluttered and efficiently proportioned with all superfluous space omitted'.

Tufte (1983) criticises cluttered tables and other failings of graphic design such as:

- excessive zeal in the use of computer software graphics packages so that bold cross-hatching and the use of wavy lines lead to distracting visual effects
- overdoing the use of horizontal and vertical lines in tables. Tables shouldn't look like nets that have caught many numbers (Tschichold 1935).

Some basic principles of graphic representation are given in Table 1.

**Table 1 Useful vs. not useful graphics**

| Useful | Not useful |
|---|---|
| • no cryptic abbreviations<br>• simple keys, or clear labelling means no legend or key is required<br>• words run in natural left to right direction<br>• simple, upper and lower case font with serifs, modestly and consistently used<br>• clearly printed<br>• graphic enlightens and arouses curiosity | • numerous abbreviations requiring searching the text for explanation<br>• elaborate or obscurely coded patterns requiring continual return to legend or key<br>• words run vertically or in several directions. Letters running vertically may be even worse<br>• multiple overbearing fonts, in upper case sans serif<br>• murky and clotted printing<br>• graphic is boring and obscures meaning<br>• strongly patterned shading, cross hatchings and overpowering colouring |

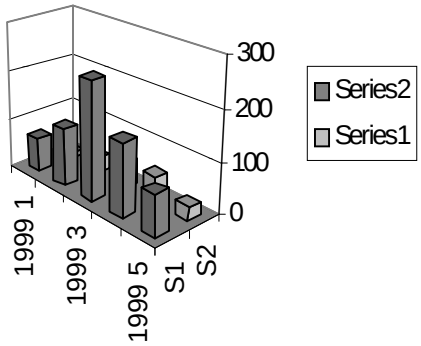
(adapted from Tufte, 1983)

## Graphs and Illustrations

Before using a graph, consider whether the information would be better presented in narrative or a table of data. Design a graph for one's audience and the presentation medium - colour vs black and white, Overhead transparency (OHT) vs Powerpoint slides on a data projector, paper vs electronic. The power of a graph is its ability to convey a variety of complex relationships in a way that is difficult to describe in words but is easily comprehended from a picture. A picture is not required to show that the men's rate of smoking , say 28%, is larger than the women's rate at say, 18%.

- Label all graphs and illustrations and refer to them in the text.
- Do not use 3D graphs. They are usually harder to interpret and more cluttered than 2D graphs. Avoid pie charts, perspective charts (3D bar and pie charts, ribbon charts), and pseudo-perspective charts (2D bar or line charts) (Figure 1).
- Avoid fussy, excessively complicated or grandiose graph design.
- Avoid bold shading of graphs and bold cross-hatching (which can cause distracting visual effects). It is preferable to use stippling in many situations or subtle crosshatching (Figure 2).
- Use colour and shading only when necessary and then, only very carefully. Avoid lurid colouring: it distracts from the message.
- Avoid graph designs that use keys. Where keys are unavoidable, use the simplest key available.
- Where several graphs are used for similar types of information use, where possible, the same scales on the x- and y-axes. If it is not possible, draw attention to the differences in scale.
- Where practicable, do not truncate axes unless this will inform rather than mislead the reader. A scale of 80 – 100 compared to 0 – 100 on an axis will exaggerate change from 83 to 87. The problems are compounded when a mixture of truncated and complete axes are used (Figure 3). The purpose of the graph should inform the scale.
- The design of a graph should make it absolutely clear to the reader when logarithmic rather than linear scales are being used on the axes of graphs.
- Always consider using a log scale when ratio data such as SMRs are being presented. Apart from the problem that on a linear scale, zero is effectively minus infinity for ratios, a linear scale also distorts the equivalence between 2 and 1/2. Both values are equally 'far' from 1, but only a log scale represents this accurately.
- Consider accompanying graphs with tables of data if readers may wish to refer to the exact figures (but also consider in these instances whether a graph was appropriate).
- Tables with more than a few numbers are reference material and belong in an appendix.
- Reduce the clutter on the page by removing the borders and grid lines.
- Do not depend on the audience to correctly interpret any visual display of data. The average level of numeracy in those with non-maths backgrounds is poor: provide a narrative in the report interpreting the important aspects of the graph.

**Figure 1 3D vs 2D**: In which is it easier to compare the ratio between series 1 and series 2 and to identify the actual values for series 1? Note also that both have been drawn using Excel and use similar amounts of space on the page: the 3D version wastes space.



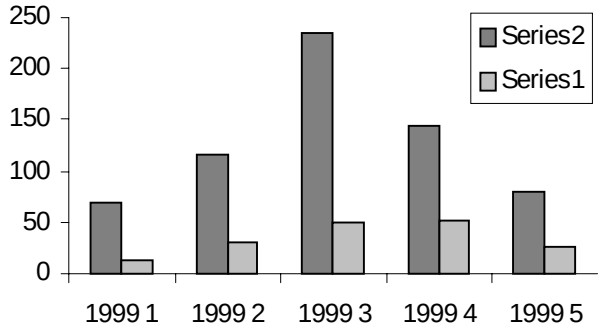
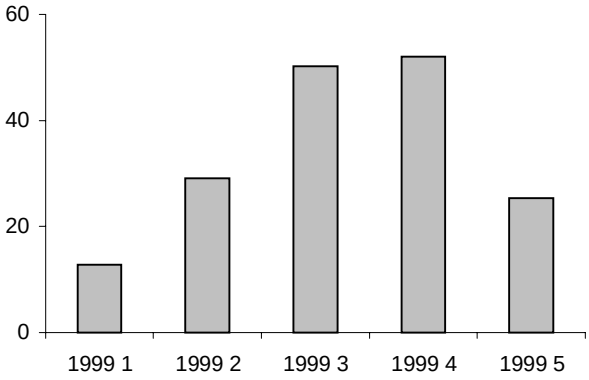




**Figure 2 Plain vs Patterned** Note the distracting visual effects.



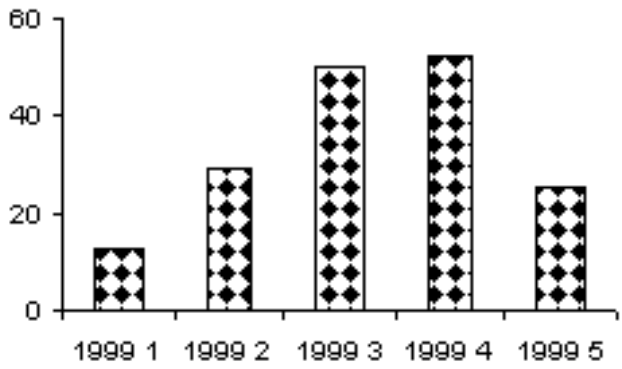
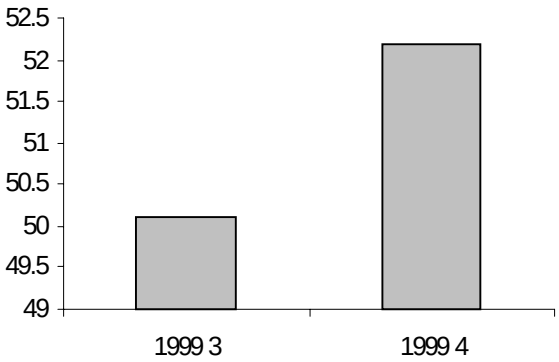
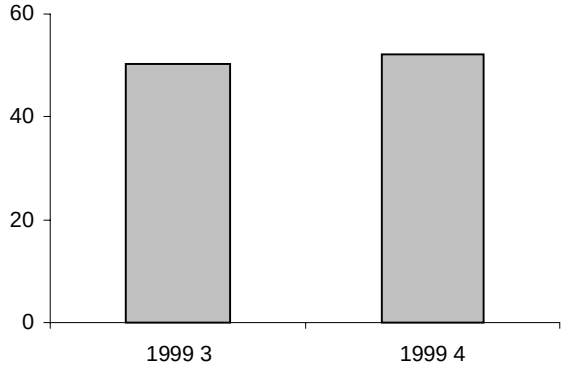




**Figure 3 Truncated vs non truncated** Excel provided the truncated version as the default when this was drawn.




The references by Tufte, in particular, are very helpful in detailing the principles of concisely presenting information.

## Colour

One should take advantage of every characteristic of an intended medium that will improve the intelligibility of a graph. If the medium offers full colour, use it (wisely). Coloured graphs almost always have greater impact than black and white, and colour can serve to enhance the intelligibility of a graph. However, there is no point in producing a graph that looks wonderful when projected up onto a screen when it is intended for publication in a monochrome printed report. If the image is to be used for both purposes it may be appropriate to produce two versions.

- If there is no information on how the document will be reproduced, assume the document will be printed in black and white. If the publication is to be printed in colour but is likely to be faxed or photocopied, ensure that graphs generated in colour will reproduce in black and white when photocopied, faxed or printed in black on white paper. Single colour printing is also considerably cheaper than multicolour printing.

- If the publication may be photocopied or faxed (particularly on low cost hardware), ensure that the colours will photocopy or fax: important headings and addresses have been printed in colours that 'disappear'.

## Graphic Design

- The fewer typefaces the better.
- Do not use fancy (fancy) lettering or fancy font effects (fancy font effects) eg. outline.
- The visual ergonomics of serif printing such as Times New Roman are usually superior to those of sans serif printing such as Arial for large pieces of text and serif printing is used for most newspapers and books.
- A mix of upper and lower case is usually easier to read than ALL CAPS WHICH ARE HARDER TO READ AND ARE A FORM OF TYPOGRAPHICAL SHOUTING.
- Light text against a dark background is harder to read.
- When using dot points change the dot to a small font (eg 8 pitch) so that the eye is not distracted from the text by a large blob.
- Boxing text can make it harder to read.

## Text

- Use plain English.
- Avoid cliches.
- Do not use jargon in text intended for a broad audience.
- Ruthlessly edit the text to remove repetition and verbiage.
- Use the Queensland Health Style Guidelines Part 2 (2002) and the *Style manual for authors, editors and printers* as the key references. They provide advice on: the principles of good writing; punctuation; spelling and usage; shortened forms; inclusive language; methods of citation; preparation of copy for printing; typographical style; types of bindings; copyright; etc.

## References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## For Further Information


Contact the Senior Epidemiologist
Ph: (07) 3250 8602