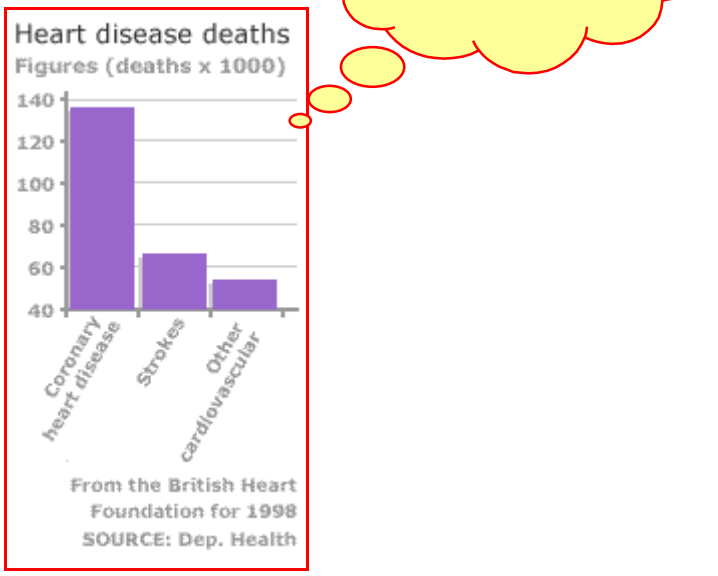
Let's Draw Some Charts …

some examples from the WWW
with suggestions for improvement



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Introduction

The purpose of this paper is to take the reader through a series of charts that relate to a number of issues relating to health care in the UK. Along the way, we will see that some of the charts suffer from having been drawn carelessly: that is, they don't always comply with good chart construction practice.

The structure of the paper is that, having described where the charts discussed in this paper have come from, the first section presents the charts one by one and says if that chart is well or badly drawn; I then recommend how to correct for any problems I found: this section is called *the charts: their faults and my suggestions*.

The second section of the paper briefly outlines the major factors to take into account when drawing effective charts: *the general rules of charting*.

The third and final section contains a *note to teachers*: some ideas of how they might use this paper with their students. For UK teachers, I've included extracts from a Business Studies A level syllabus in an attempt to show how this paper can be integrated into a Business Studies programme. Of course, charts are used by accountants, economists and a whole host of other people too, so anyone is welcome to read this paper!

Where the charts came from

What follows is based on the charts that I found on the BBC web site as I came across their pages concerned with the debate about the National Health Service (NHS).

I'm not in the least bit concerned here with the rights or wrongs of health service provision in the UK, since it's a minefield of management issues that will or won't be resolved to the satisfaction of the majority!

However, what I have done is to start at the following web page:

http://news.bbc.co.uk/vote2001/hi/english/main_issues/sections/facts/newsid_1182000/1182625.stm

and then follow through the links I found on the right hand side of that page.

All of the charts I found are reproduced below. Since they seem to come from a variety of sources, and this page is written for educational purposes only, I don't think there is a copyright problem. If I'm wrong about the copyright issue, I'll negotiate with anyone and remove what I have to remove.

The Charts: their faults and my suggestions

So here are the charts, exactly as they appear on the BBC site. Alongside the charts I have provided a commentary that says what's good and/or what's bad about the chart from a presentation/reader's viewpoint. I also suggest an alternative or two to help a fair analysis along.

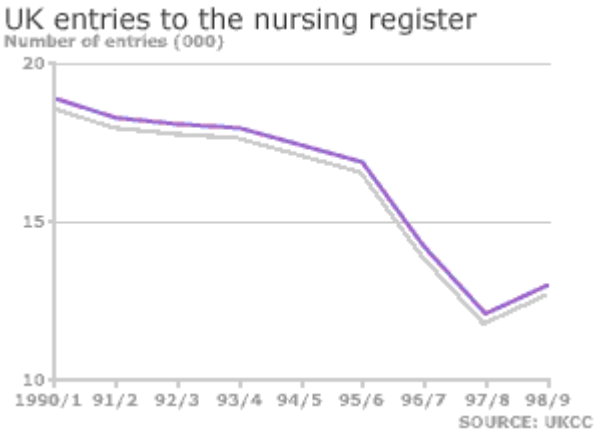

Figure 1

Problem: Left hand scale starts at 10, which is 50% of the way up the vertical scale. This creates the impression that the change in the number of nurses entering their profession is much more significant than it actually is.

Alternative: start the scale at 0; and provide a table with rates of change from year to year.

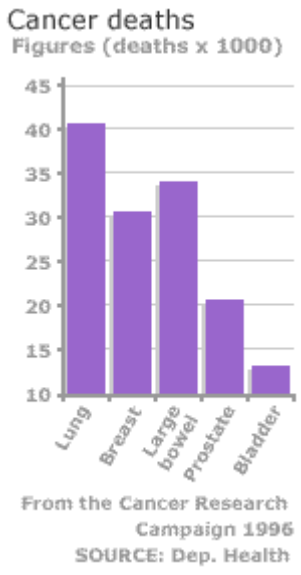

Figure 2

Problem: Vertical scale doesn't start at zero. Maybe not a serious problem for this chart; but it does tend to underestimate the severity of prostate and bladder cancer.

Additionally, why is the death from breast cancer bar in second place (reading from the left)? What impression are they trying to create by having this bar essentially out of order?

Alternative: start the vertical scale at 0; and have the bars either in ascending or descending order reading from left to right.

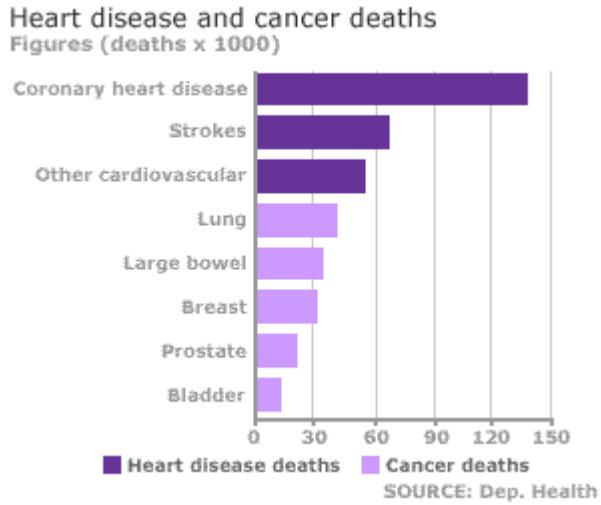

Figure 3

Problem: no problem, this is a good chart, I would say: not only are the scales fair, but the horizontal bar style helps to highlight the fact that coronary heart disease is a serious problem … leading us nicely into a debate about preventive medicine and so on. They've even used colour differentiation to distinguish deaths from heart disease from deaths from cancer.

Alternative: none suggested.

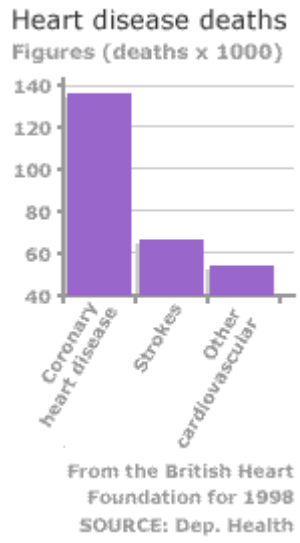

Figure 4

Problem: Vertical scale broken again. Here the scale starts at 40, which is about 30% of the way up the full vertical scale. **Just look at the impact that this chart has on the chart in figure 3**. Now, the incidence of strokes and other cardiovascular problems is grossly understated.

Alternative: use proper scaling

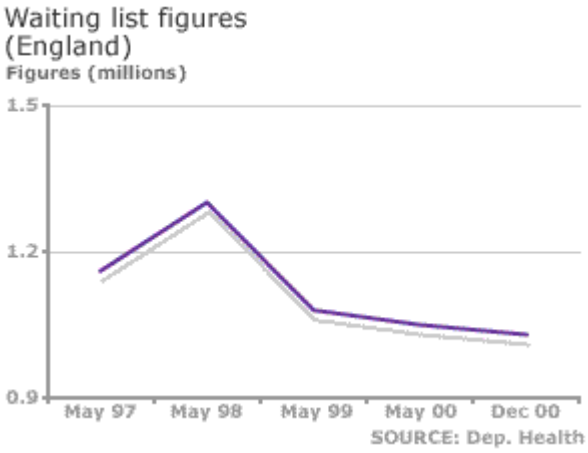

Figure 5

Problem: Vertical scale broken yet again: this time, the scale starts 60% of the way up, rather than at zero, where it ought to start. Again, the impression is that changes in waiting lists are more dramatic than they really are.

Alternative: put the vertical scale back to starting at zero and provide a table that shows rates of change from year to year.

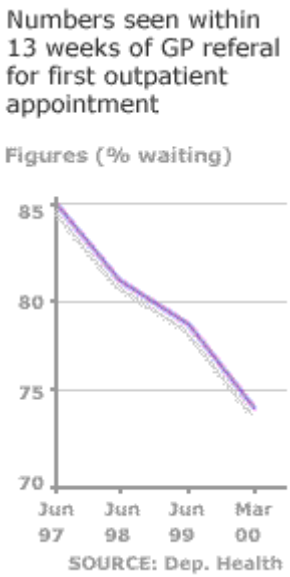

Figure 6

Problem: The worst offender in terms of cheating, with the vertical scale: by starting at 70%, they are starting just over 80% of the way up the scale. Redraw this with a full scale and see the impact this change has on the overall impact of the information contained in the chart.

They have also messed with the horizontal scale: they have gone from June to June for the years 97 to 99 and then have gone from June 99 to March 2000; yet they haven't changed the size of the gap between the points.

Alternative: put the correct vertical scale on the chart and adjust the June 99 to March 2000 gap to its proper size.

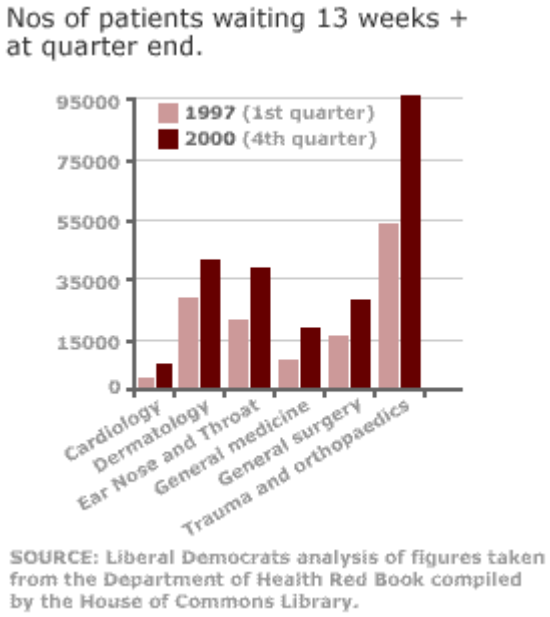

Figure 7

Problem: Looks like the horizontal scale has been ordered alphabetically by medical specialty, creating a roller coaster effect: does this help the reader to appreciate the content and message of the chart?

Why have they chosen to compare 1st quarter 1999 with 4th quarter 2000?

Alternative: maybe none; after all, ordering alphabetically may not be a bad thing; comparing the quarters they have might be valid … we should investigate the text that accompanies the chart to understand the arguments here.

Possibly suggest preparing a chart that simply shows the changes between the two quarters: absolute or relative values.

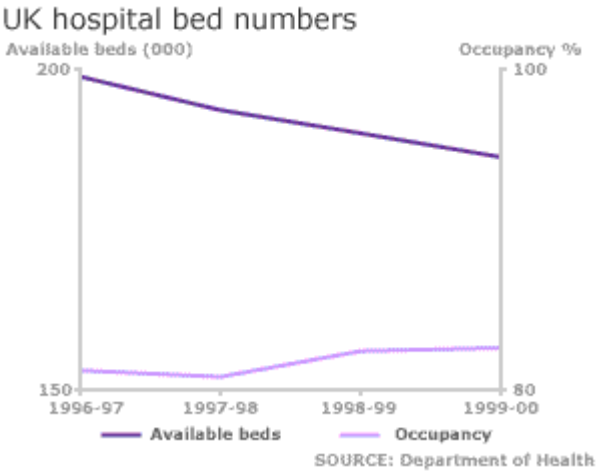

Figure 8

Problem: Two vertical scales and they have both been broken very badly. The impressions created are grossly inconsistent with reality, aren't they?

Alternative: change the scaling.

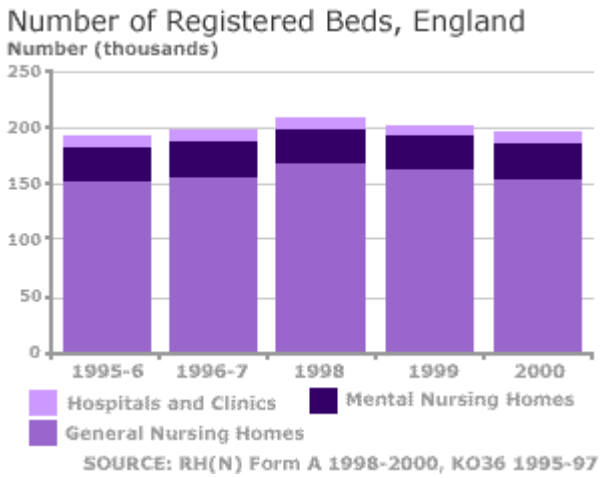

Figure 9

Problem: The horizontal scale is unusual: it starts as 1995-6 and ends simply with 2000: a change of reporting year end?

Alternative: see the accompanying text in the article from which this came to see if there is an explanation for the change in horizontal scale.

Otherwise, this chart is fine, even though the bars maybe a bit chunky!

General Rules of Charting

Let's review a few pointers to presenting good charts to see what I was looking for and why I have made some of the suggestions I have.

Charts should stand alone

I have taken these charts out of context but most of them stand on their own merits, which is good. Even though I have been critical of most of the charts, the basic content underlying each chart is clear.

Title

Every chart needs a clear, unambiguous title.

Scales

Scales should be included and should not be broken, unless it makes sense to do so. I have criticized breaking of scales in these examples since the breaking of them wasn't admitted! There will be cases where someone else might accept broken scales whereas I might not.

Legend/data labels

Where there is more than one line or curve or bar … on a chart, there ought to be a legend, or data labels to help the reader identify the series being discussed/analysed.

Labels

Axes ought to be clearly labelled and the labels need to be unambiguous.

Source

Where appropriate, the source of data on which a chart is based needs to be stated so that the reader can check and verify the data if they wish or are able.

Colour

Use colours to make the charts more attractive and to distinguish between data points … maybe this is especially true when multiple vertical axes are used. Using broken lines and solid lines when the use of colour is not appropriate is an acceptable alternative.

Uncluttered

Like Feng Shui, a chart should not be cluttered: make it clear, neat and tidy!

Number of lines/series

Usually, the maximum number of data series/curves/lines on a chart should not exceed six, otherwise it gets too complex, unreadable and cluttered.

Double axes

Use double vertical exes where it helps.

Conclusions

The aim of this paper is to help readers to appreciate that even when the source of a chart might be impeccable, if they are badly drawn and presented, charts can create the wrong impression.

In some cases, charts are deliberately drawn in such a way that they *intend* to mislead readers. We can use such techniques to enhance our argument, too, by emphasizing points or de-emphasising points.

I am not suggesting here that the BBC or any of the organisations referred to in the Sources shown on the charts have deliberately set out to mislead. However, the problems I have pointed out might have that effect.

Please feel free to contact me at duncan.williamson@tesco.net with any comments and criticisms about this paper. I'll be happy to hear from you whatever you think.

NOTE TO TEACHERS: you can easily use these examples as class based work.

1 Students can visit the BBC site and find these charts themselves. They can then do what I have done here, which is to look critically at how the charts have been put together.
2 Get them to put the charts in the context of the text on the page on which they find them: something I haven't done here … does this help to excuse the faults in the chart?
3 Students might redraw the charts along the lines of the alternatives I have suggested, or that they suggest themselves. They can draft the tables I suggested in section 1 as well. Then they can comment on their findings.
4 Maybe the students can suggest alternative types of charts as more appropriate in some cases? I haven't suggested alternative types here; but maybe a pie chart is better, a 100% stacked bar chart …
5 Encourage students to look around them and find examples of good and bad charting practice. One of the best examples used to be, maybe still is, the graph they had on a jar of Horlicks that showed us how the depth of our sleep improved following a sharp intake of Horlicks!

PUTTING THIS PAPER INTO A BUSINESS STUDIES CONTEXT

In terms of how this paper fits into a teaching rationale, let me guide you to just one example: the AQA AS and A Level Business Studies guidelines. However overtly or covertly, I can find a place for including the above kind of work within the following parts of the syllabus, by way of a non exhaustive series of examples from the A2 section of the syllabus.

A2 Module 6
15.3 Social and Other Opportunities and Constraints
14.5 Controlling Operations
A2 Module 5
14.1 Communication
A2 Module 4
13.1 Market Analysis
A2 Module 3
12.4 Starting a Small Firm
12.5 Business Objectives
12.6 Business Strategy
(For module 3, I am referring to the process here rather than simply being a slave to the context and content of the syllabus)

Of course, not only business studies students need to think about charting: charts are used by accountants, economists, mathematicians and statisticians, scientists and technologists and politicians … this paper has been written to help us all think more carefully about charts and their construction.