# Chart and Dashboard Guidance

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1 - Introduction
This paper outlines the design guidelines which should be followed when creating charts and dashboards for Public Health and Intelligence (PHI). This includes content for the website, as well as charts included in summaries and reports.

As a basis for chart design, the Office for National Statistics (ONS) Data visualisation style guide should be followed. This paper summarises the most important points from the ONS guide and gives examples and instructions for how these can be implemented in a PHI context. Additionally, this guide includes instructions on how the NSS design manual should be implemented for web based charts and dashboards.

Please note, if you are planning to create new charts or dashboards for the ISD or HPS websites it is recommended to first contact the PHI publications team (NSS.PHIPublications@nhs.net). They will be able to advise what is possible on the websites, on what times scale and bring you in touch with other teams that work on similar projects.

2 - General Chart Design

The following advice should be considered when creating any chart:

1. **Keep it simple.** If there are several relationships in the data, separate the data into several charts.
2. **The maximum number of lines** plotted on a chart depends on how similar or different the data are and what you want to highlight. Break up the data in separate charts if needed.
3. **Location of the y-axis** is normally on the left side of the chart. Try to avoid using double or secondary y-axes, **consider putting two charts side by side instead.**
4. **Use gridlines sparingly.** There should usually be between four and eight gridlines per chart, depending on the size of the chart and the level of data. They should provide enough reference points to read the data values in the chart easily. Gridlines should always be grey: #bebebe, RGB(190,190,190).
5. Don’t use **borders and backgrounds** for charts.
6. Don’t use **3D** when creating charts.
7. Start data that are likely to be compared from the same point on a chart – a shared **horizon.** Use a clustered chart to compare values; only the first category is easily comparable in stacked bar charts.

3 - Chart titles and text

1. **Axis labels and tick marks:**
   1. For continuous data axes centrally align labels over tick marks.
   2. For categorical data axes labels should be aligned between tick marks.
   3. You can use more tick marks than labels; ticks indicate the scale or level of detail of the data.
   4. Label the final tick if there are more ticks than labels and there is space to do so.
2. **A legend or key** shouldn’t be used, instead label the data directly. If a legend or key is necessary, place it on the chart as close as possible to the data. The order and orientation of the legend or key should be the same as the data.
3. Use a horizontal bar chart rather than a vertical bar chart if your data has **long category names.**
4. If the **subcategories** are not the same in all of the main categories, label the main categories and subcategories directly on the y-axis.
5. **Chart titles:**

1. Label charts as a figure and number them in order. Figures should have a main title and a statistical subtitle. Titles and subtitles should be concise and in sentence case.
2. The main title should be descriptive, and tell the trend of the data or highlight the main story. Try to limit the number of words to no more than 10. This should make the description easier to read and avoid the text wrapping onto several lines, especially on mobile devices.
3. The statistical subtitle should be as short as possible and must include the:
   - statistical measure
   - geographic coverage
   - time period
4. You do not need to include these elements in the subtitle if they are already in the main heading.
5. When writing your chart title and analysis:
   - use chart titles to complement or build on, but to not repeat section headings,
   - add further context and explanation of the chart’s message in your main text,
   - do not try and summarise everything the chart says in the title, but prioritise the main message.
6. If a chart has more than one narrative, choose the one that will be most relevant to users for the main title. Use annotations to draw attention to secondary messages, but do not try and explain every nuance in the chart when your analysis can provide more detail.
7. Sometimes a graphic may genuinely be one you wish your user to explore – there is no immediate story or message on display. In these rare cases, it is acceptable to use a title that encourages the reader to explore the graphic.

6. **Chart labels:** Chart text must be horizontal. If the labels won’t fit into the required space, transpose the chart or convert the units.

4 - Colours

Base colour for charts:

- Primary blue: #004785, rgb(0,71,133)

Blue colours with different hue and saturation for charts with order:

- #004785, rgb(0,71,133)
- #00a2e5, rgb(0, 162, 229)
- #4c7ea9, rgb(76, 126, 169)
- #99daf5, rgb(153, 218, 245)
- #4cbeed, rgb(76, 190, 237)

Additional colour options:

- Secondary blue: #007db3, rgb(0,125,179)
- Yellow: #ffcd04, rgb(255, 205, 4)
- Red: #d20c0c, rgb(210, 12, 12)
- Light blue: #cfe5f7, rgb(207, 229, 247)
When deciding what colours to use in a chart:

1. Don’t rely on colour alone to communicate the stories in your data. The important messages communicated by the data must be clear if the graphic is viewed in black and white or if the user is colour-blind.

2. **Bar charts:**
   1. For categorical data that can’t be organised into broad groups use the same colour and shade.
   2. If the categorical data can be grouped use colour to help highlight this relationship.

3. **Line charts:**
   1. Use colour to distinguish between lines on a line chart. If the data has an implied order, for example age ranges, use different shades of one colour, or colours with different luminance values, but the same hue and saturation.
   2. If the data has no implied order, for example male and female, different colours (hues) can be used.
   3. Try to avoid using more than four shades of one colour on a line chart without using another mechanism to differentiate between them.

4. **Accessibility:**
   1. Make sure your design works in greyscale (black and white) before adding in colour. Don’t assume colours will signal meaning when used on their own.
   2. The richest colour across all types of colour blindness is blue, therefore blue is often a good colour choice.
   3. Avoid using red and green together as they are difficult to distinguish from one another in the more common types of colour blindness.
   4. Colour-blind people can still perceive contrast, as well as differences in hue, saturation and brightness. Use bright colours which are easier to distinguish rather than dim ones, which tend to blur into one another.
   5. Some mildly colour-blind people are able to see a colour, but only if there’s a sufficient “mass” of it. Use larger areas and thicker lines if possible.
   6. If you’re using red to signal “warning,” or “caution,” and green to signal “approval” or “correctness” consider adding a symbol to make sure colour-blind users can still understand the message.

### 5 - Time Series Charts

1. Time x-axis should always run from left to right
2. **Bars** should be used to emphasize individual values at distinct points in time. Use them when data points are at equal intervals
3. **A line chart** will emphasise the overall pattern of the data and highlight trends. Use them when you have lots of data points or just a few. Multiple times series should always use line charts.
4. Use a **dot plot with a line** when there are lots of data points or the interval between data points is not equal. Show if data are irregular.
5. **Multiple time series** shouldn’t be presented using bar charts. Use a line chart to make sure the trends in the series are clear. Use points on a line to highlight individual data points, to read specific values or highlight when the data were sampled.
6. **Time series charts don’t have to begin at zero**, if a chart doesn’t start at zero this must be indicated by breaking the y-axis in an obvious way.

Line chart example:
6 - Bar and Pie Charts

1. Use bar charts to show data that are ranked, in either ascending or descending order. Horizontal bars should be used.
2. A bar chart should always be ranked by value, unless there is a natural order to the data (for example, age or time).
3. A standard bar chart should have gaps between bars that are slightly narrower than the bars.
4. Bar charts and pie charts should be used to show part to whole relationships.
5. Pie charts should only be used when there are less than six categories, otherwise use a bar chart or, if appropriate, combine categories.
6. Rank the categories in a pie chart and start the first segment at the 12 o’clock position.
7. Segments of a pie chart must sum to 100%. If the categories do not sum to a meaningful whole, don’t use a pie chart.
8. Where appropriate categories can be combined to highlight a certain message but should never be removed.
9. Use a bar chart to plot deviation from a fixed value, or series of values.

Barchart example:
7 - Presenting Distributions

1. **Distributions:**
   1. Use a histogram to show a distribution of data. Use small gaps between the bars to emphasise the profile of the data.
   2. Use a population pyramid to show the distribution of comparable data sets and highlight differences in the profile of the data.
   3. To compare four variables population pyramids can be overlaid, with the least important data set displayed using an outline pyramid instead of bars.
   4. Box-plots can also be used to compare distributions with two or more variables.

8 - Online charts

Responsive design:
The new ISD website has a responsive design based on 12 columns that changes the layout depending on the screen resolution. Four screen resolutions define the main layout breakpoints:

1. small: 320px
2. medium: 740px
3. large: 980px
4. xlarge: 1300px

The aim should be to design charts and dashboards that work on all these screen sizes, so the information is accessible from as many devices as possible.
Please note further investigation of responsive design of charts in RShiny is required. As a temporary solution RShiny dashboards can be set to desktop view on mobile by adding the following to the top of the UI code:

- For RShiny in TPP publications:
  
  HTML('<meta name="viewport" content="width=1200">')

- For RShiny embedded in the old ISD Website

  HTML('<meta name="viewport" content="width=950">')

To make the iFrame with the RShiny dashboard adjust to the vertical size of the dashboard, add the code below to the RShiny UI Script and inform the PHI Publications team that you have added it to the dashboard.

Add this at the beginning of the UI script:

```html
tags$head(
    tags$script(src="https://cdnjs.cloudflare.com/ajax/libs/iframe-resizer/3.5.16/iframeResizer.contentWindow.min.js",
    type="text/javascript")
),
```

Add this placeholder "<div>" at the bottom of the UI script, indicating where the page ends:

HTML('<div data-iframe-height></div>')</div>

### 9 - Dashboards

The above guidelines for chart types and chart design should also be implemented for charts in a dashboard. Following the guidance below will improve consistency in dashboards between publications. Please note that due to differences in technology not all off this guidance will be possible to implement:

1. **buttons** – blue and square.

2. **tables** – bold headers, light horizontal lines.

3. **dropowns (select)** – square, blue option selection, yellow highlight line
4. **typeface (“Neue Helvetica”)**

5. **Tabs** - icons should be on the left side of tab titles. Tabs should be blue when selected.

6. Icons –
   - 🛜 Information icon
   - ⬇️ Time trend icon
   - ⏰ Non time trend icon
   - 🧙‍♂️ Demographics icon
   - ⬛ Cross boundary icon
   - 📊 Tables icon

7. Include a button to hide and show a table under the chart and link in the text above the charts to this button.

8. Include an option to download a glossary explaining key technical terms on all tabs of the dashboard.

9. Include a note about disclosure control on each tab where disclosure control has been applied.

10. Charts must have titles.

11. For figures in the text that update with location selection, either only the figures are bold or nothing in bold.
Appendix I: Additional examples

Area Chart example:

Scotland

Cross-boundary chart example

In 2017/2018, 98.2% of patients from NHS Greater Glasgow & Clyde were treated within their own board (3330 individuals). The other 1.8% (60 individuals) were treated in:

- The State Hospitals Board for Scotland
- NHS Ayrshire & Arran
- NHS Lanarkshire
- NHS Lothian
- NHS Tayside