Best Practices Recommendations

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1. **Content** Every graph should stand on its own
   1. It should tell its story without a need for detailed explanatory text or supporting documents.
   2. It should be clear, effective and informative for the intended audience.
2. **Communication** Tailor each graph to its primary communication purpose
   1. What insight is the graph intended to convey? Is it intuitive?
   2. Avoid packing too much information into a single display and distracting from the main message.
3. **Information** Maximize the data-to-ink ratio
   1. Each spot of ink should be necessary for imparting the main message
   2. Do not clutter a graph with what you don't need. Less is more.
4. **Annotation** Provide legible text and information
   1. Position annotation (including legends) so that it aids interpretation and does not distract from the message.
   2. Use legible font that can be read without eye strain or a great deal of effort. Consider the format (presentation or document)
5. **Axes** Design axes to aid interpretation of a graph
   1. Scale axes to show the interesting features of the data; for example, for longitudinal data, use time (on a continuous scale) instead of visit number (on an ordinal scale).
   2. Give careful consideration to inclusion of the zero of each axis; if excluded, ensure its absence is clearly sign-posted.
   3. Avoid crowded axes.
   4. Use the same axis scales on graphs that need to be compared.
   5. Choose the appropriate style of axes. For example, select between a box, X and Y axes, X only, Y only; consider grid lines; ensure intelligent placing of tick marks.
   6. If the nature of the data suggests the shape of the graphics, follow that suggestion; otherwise, use horizontal graphics about 50% wider than tall.
6. **Styles** Make symbols and plot lines distinct and readable
   1. Choose plot symbols with simple, familiar shapes and intuitive interpretation (eg 'A' for active and 'P' for placebo)
   2. If a graph is to be displayed by projection onto a screen, or in a poster, use thick lines, large symbols and large fonts to achieve legible display.
   3. Where possible and appropriate, data representations (such as styles of symbols, lines and bars) should have the same meaning across all similar graphs within a package; for example, if one line graph uses a solid blue line to represent Placebo, all graphs in the package should use a solid blue line for Placebo.

7. **Colors** Make use of color if appropriate for the medium of communication
    1. Use color only when it decodes information. When color is used, choose contrasting and clearly visible colors; avoid yellow, and contrasts with red, green or brown which are difficult for people with color-deficient vision.
    2. If a graph may be viewed in black and white, ensure that all distinctions made by color are also made by other features such as symbols and line-styles.
    3. For black-and-white media, make use of line-styles (dashing and gray levels) that are easy to distinguish.
    4. Design backgrounds to set off the graph, not compete with it.
    5. Choose area fills that are distinct but compatible.
    6. Make secondary plot lines lighter in weight, color or style.
    7. Keep reference lines and grids distinct from other data lines.
    8. Color Brewer is an excellent reference for choice of colors.
8. **Techniques** Use established techniques to clarify the message
    1. Show causality: when a causal relationship exists between variables make sure it is easily discernable from the graph.
    2. Make comparisons from a common baseline.
    3. Sort categories according to relevant features of the data.
    4. Do not introduce spurious dimensions to a graph, as they reduce clarity.
    5. Combine multiple images into a single display when information needs to be presented together.
    6. When a graph summarizes data at an aggregate level, always plot estimates of variability in the data.
9. **Types of plots** Use the simplest plot that is appropriate for the information to be displayed (see Select the Right Graph for My Question)
    1. To show a distribution of values, use whichever form is most appropriate: rugplot, strip plot, dotplot, boxplot, histogram, CDF plot, or more specialized display.
    2. Use scatter and line plots to show association between a pair of variables, thinking carefully about the representation of variability of actual data.
    3. Use trellis displays to show changes in association between a pair of variables with respect to a third variable.