BCA

Biostatistics Collaboration of Australia

GUIDELINES FOR REPORTING STATISTICAL RESULTS

Based on guidelines presented in the notes for Introductory Biostatistics, a unit of the Master of Public Health degree offered by the School of Public Health, University of Sydney.

Introduction

When reporting statistical results it is crucial that they are presented in a neat, concise manner. This can greatly assist the reader in understanding the results, and in turn how they relate to the research question(s). Messy presentation, such as poorly structured tables, inadequately labelled axes on graphs and superfluous precision of estimates makes for more difficult reading and is unacceptable for peer-reviewed journals.

The objective of this document is to provide guidelines for the reporting of statistical results and to give examples of what the BCA considers acceptable presentation of tables and figures for assignments.

Precision of reported results

Based on quote from Gardner and Altman (Statistics with Confidence, 1989):

"Spurious precision adds no value to a paper and even detracts from its readability and credibility. Results obtained from a calculator or computer usually need to be rounded."

- When presenting means, standard deviations, and other statistics the author should bear in mind the precision of the original data.
- Means should not normally be given to more than one decimal place more than the raw data, but standard deviations or standard errors may need to be quoted to one extra decimal place [i.e. one more than the mean, e.g. when the SD or SE is small relative to the mean].
- It is rarely necessary to quote percentages to more than one decimal place, and even one decimal place is often not needed. *With samples of less than 100 the use of decimal places implies unwarranted precision and should be avoided.*
- **Note that these remarks apply only to presentation of results - rounding should <u>not</u> be used before or during analysis.**
- It is sufficient to quote values of t, χ^2, and r to two decimal places.
- P-values should be quoted to 1, or at most 2, significant figures.
- Do not use the abbreviation NS for P-values greater than 0.05, or asterisks (*) for different categories of P-value less than 0.05, but report the actual P-value.

Notes:

The number of ***decimal places*** is the number of digits after the decimal point.

The number of ***significant figures*** is a more general indication of the precision of a number. It is determined as follows:

1. Count the number of digits, beginning with the first non-zero digit, reading from left to right.
2. Ignore all zeros at the end of a whole number, unless you know them to be exact.
3. Zeros at the end of a decimal number are always significant.

For example:

3500, 0.0062, 0.050 each have 2 significant figures

50600, 8.02, 0.0920 each have 3 significant figures

Guidelines for Preparing Tables and Graphs

1. Tables and graphs should be self-explanatory, so they should have a title; all axes, rows and columns should be labelled unambiguously; and units should be given.
2. Missing values such as 'don't know' or 'not answered' should either be included as a separate class, or a footnote should be given noting that they are omitted.
3. If percentages are given, it should be clear what the denominator is.
4. Where the vertical scale has a natural origin, it should either be included, or it should be emphasised that it is not.

5. Use spacing, not vertical lines, to separate columns in tables. In general, minimise the use of "gridlines".

6. Three-dimensional graphics (e.g. 3D bar charts) should be avoided unless you are showing the complex relationship among three variables (e.g. an interaction effect).

Guidelines for Preparing Frequency Distributions & Histograms

1. Class boundaries should be round numbers.
2. It should be unambiguous in which class a boundary value goes; usually the boundary is in the class above.
3. The number of classes should be small enough to provide regularity in the shape of the distribution, but large enough not to lose too much detail. Usually 5 to 15 classes are sufficient.
4. Where there are conventions covering 1), 2) and 3) above, these conventions should be followed; e.g. age-groups start with 0 or 5.
5. Classes can be combined later, but not divided, so use too many, rather than too few initially.

More detailed guidelines can be found in How to Report Statistics in Medicine (2nd edition), Thomas A Lang and Michelle Secic. *Philadelphia: American College of Physicians, 2006.*

Graph examples

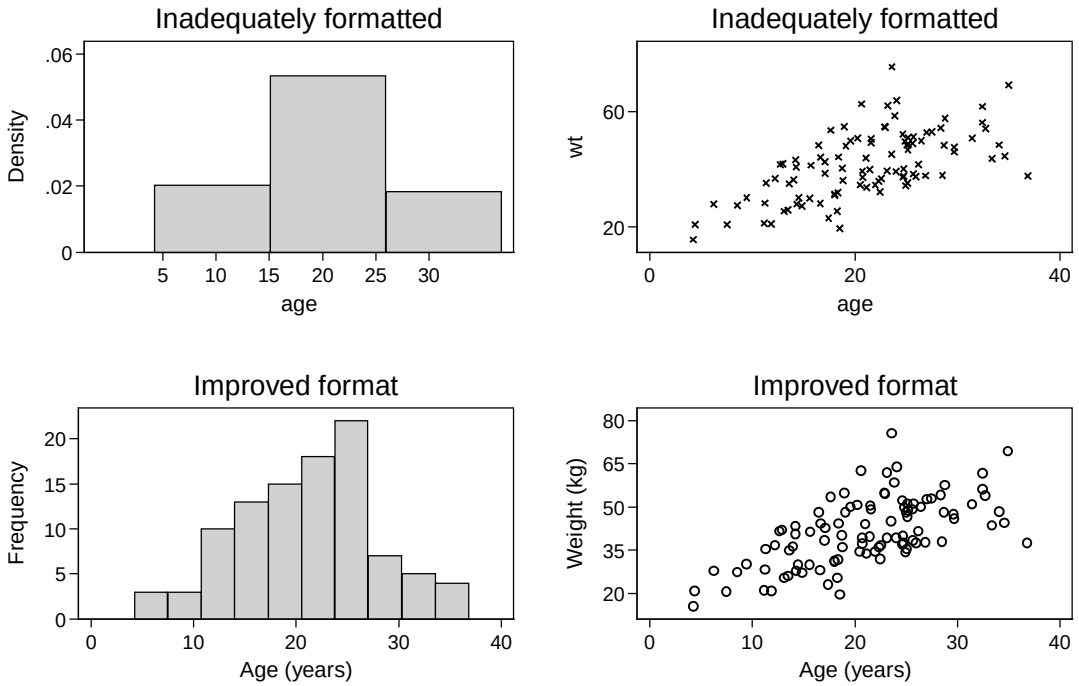

Figure 1: Examples of inadequately formatted graphs and graphs with improved formatting

Problems with the top-left histogram:

- The "bins" (i.e. the age groups produced by the default setting) are too wide, providing a only a very coarse description of the age distribution
- There are no units for age (e.g. years, months)
- "Density" is on the y-axis, which is not an intuitive measure of the size (or relative size) of each age group (bin)

Improvements to the histogram (bottom-left):

- There are an appropriate number of "bins", which provides a more detailed description of the distribution and seems to provide a good trade-off between smoothness and precision
- Age is properly labeled with units in brackets
- The frequency is displayed on the y-axis, providing a straightforward measure of the size of each age group (i.e. the number of people in each "bin")

Problems with the top-right scatterplot:

- The axes are labeled with the variable names, which in the case of "wt" requires the reader to guess what this stands for
- For both axes, the incremental increase in units is very large, making it difficult to identify weights for specific ages
- The plot symbols appear fuzzy

Improvements to the scatterplot (bottom-right):

- The axes have meaningful labels with units in brackets
- For both axes, the incremental increase in units is smaller, making it easier to identify weights for specific ages
- The plot symbols are clearer

In addition, you should always include a figure label above or below the graph (below in this case), which numbers the figure (for reference in the text) and clearly describes what is being displayed.

Table examples

Inadequately formatted:

The MEANS Procedure

Variable	N	Mean	Std Dev	Minimum	Maximum
SBPA	1080	131.1796481	10.9672201	98.9100000	171.1200000
DBPA	1080	81.7043889	8.2490641	48.2300000	106.2800000
HRA	1080	72.7800000	8.1729036	48.8600000	100.9400000
SBPA3m	795	130.3802390	11.0160729	100.3400000	168.6500000
DBPA3m	795	81.0252579	8.2270743	48.1400000	106.6800000
HRA3m	795	72.1476981	8.3003315	47.0700000	96.7500000
SBPA5y	233	133.8000858	10.2820711	108.4500000	167.5700000
DBPA5y	233	82.1574678	7.2404082	63.0500000	102.2600000
HRA5y	233	72.3622318	8.6014242	47.7400000	102.8400000
SBPAe	87	139.4104598	12.2275038	109.8100000	168.6400000
DBPAe	87	88.9980460	8.8186379	58.5000000	104.6600000
HRAe	87	73.2763218	9.0440817	51.6000000	97.2600000

This table was copied and pasted directly from the SAS results window. Problems include:

- Superfluous precision (i.e. too many decimal places)
- The columns are not aligned
- The entries in the "Variable" column are not labeled
- The SAS procedure name ("the MEANS procedure") is unnecessarily displayed
- The lines at the top and bottom of the table are not long enough and are dashed (should be solid)
- There is no description of what the table is displaying

Improved format:

Table 1: Summary statistics for ambulatory systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR).

Time	Variable	N	Minimum	Maximum	Mean	Median	SD
Baseline	DBP	1080	48.2	106.3	81.7	82.2	8.3
	SBP	1080	98.9	171.1	131.2	131.1	11.0
	HR	1080	48.9	100.9	72.8	72.7	8.2
3 month	DBP	795	48.1	106.7	81.0	81.2	8.2
	SBP	795	100.3	168.7	130.4	130.2	11.0
	HR	795	47.1	96.8	72.2	72.1	8.3
5 year	DBP	233	63.1	182.3	82.2	82.2	7.2
	SBP	233	108.5	167.6	133.8	133.3	10.3
	HR	233	47.7	102.8	72.4	72.3	8.6
Endpoint	DBP	87	58.5	104.7	89.0	90.9	8.8
	SBP	87	109.8	168.6	139.4	138.6	12.2
	HR	87	51.6	97.3	73.3	74.7	9.0

Improvements:

- Concise and consistent precision
- Minimal use of lines
- The columns are aligned and clearly labeled
- The numbers in each column are right-aligned to force the decimal points to be aligned
- The rows are more clearly labeled
- The table is labeled with a number (for reference in the text) and also with a clear description of what is being displayed

Cross-tabulation examples

Inadequately formatted:

```
+----------------+
| Key            |
|----------------|
|   frequency    |
| row percentage |
+----------------+

hypB |         hypA
     |       0       1 |     Total
-----------+----------------------+----------
       0 |     212         3 |       215
         |   98.60      1.40 |    100.00
-----------+----------------------+----------
       1 |      92        13 |       105
         |   87.62     12.38 |    100.00
-----------+----------------------+----------
   Total |     304        16 |       320
         |   95.00      5.00 |    100.00
```

This table was copied and pasted directly from Stata. Problems include:

- Lack of alignment, making it very difficult to read
- Ugly use of pluses and minuses for row, column and cell distinction
- The rows and columns are labeled with the variable names, which are uninformative
- Values of each variable are displayed as 0 and 1 (what do they mean?)
- There is no description of what is being displaying

Improved format:

Table 1: Cross tabulation of hypertension status using clinical and ambulatory measures. Row percentages are displayed below the cell counts in brackets.

		Hypertension using the ambulatory measure		
		Yes	**No**	**Total**
Hypertension using the clinical measure	**Yes**	212 (98.6%)	3 (1.4%)	215 (100.0%)
	No	92 (87.6%)	12 (12.4%)	105 (100.0%)
	Total	304 (95.0%)	16 (5.0%)	320 (100.0%)

Improvements:

- Rows, columns, numbers and percentages are aligned
- Minimal use of lines
- Rows and columns are clearly labeled with meaningful names (Hypertension using the X measure) and values (Yes, No)
- The table is labeled with a number and description