Presenting Research Results: Do’s and Don’ts
SON – Brown Bag – 12/18/12

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Outline

• General guidelines

• Essential tips for statistical reporting

• Formatting figures and tables
General Guidelines

Who is the audience?

Presentation (listener, snapshots)

Publication (reader, more time for review)
Be CLEAR on the message to be conveyed
Publication Considerations - Sections

• Introduction – Background and Why
• Methods – Study design, definitions, analysis approach, (description of study population??), but no results
• Results – Description of study population, primary and secondary results – just the facts, but no methods, and no discussion or interpretation
• Discussion – Interpretation of previously presented results ONLY!!!
• Conclusions – Highlights of Results and Discussion
Publication Considerations – Tables and Graphs

• Publisher’s requirements
  – Limitations on table length/structure/separating lines
  – B/W vs color graphics, resolution, file format

• Tables and graphs MUST be able to STAND ALONE.

• Consistency of set up across tables and graphs
Methods

• Flow chart of study population – consort diagram
• Statistical approach/assumptions
• Missing data
• Other components
Flow charts are your friend; you can tell your story with one

![Flow chart diagram]

**Figure 1.** Participant tracking.

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Statistical Approach/Assumptions I

• Confirm that data meet needed assumptions for statistical tests used
  – distribution; independence; linearity; constant variance

• Distribution:
  Example: T-tests assumes normal distribution of sample means, which holds if
  (i) Data are normally distributed
  (ii) Sample size is “sufficiently large”

• Use nonparametric statistical test if:
  (i) small sample size
  (ii) skewed data
Statistical Approach/Assumptions II

Independent or correlated data
• Use paired T-test on correlated data
• Use special methods for regression modeling
  – Robust variance
  – Generalized estimating equations (GEE)
  – Random-effects models

Checking for/handling constant variance
• Important for ANOVA or regression

Checking for/handling influential points or outliers

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Outliers and Influential Observations

Scatterplot of Y-vs- X

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Lack of Linear Fit

Residuals -vs- Predicted Values; Outlier Excluded

Scatterplot of Y -vs- X
Planning for Missing Data

• Do you expect to have any missing data?
• Why might the data be missing? (examples: lab accident/problems, participant drop-out, missing visits, non-responses)
• What aspects of the missing data may be more than minimal?
• What techniques might be used to assess the effects of missing data?
Other Components

• State the level of significance (\(\alpha\)) used
groups. Analysis of variance was used to compare total scale data between married and single mothers. The significance level was set apriori at .05.

• Cite the statistical software package used
to determine factors independently associated with perception of risk for CVD. SPSS version 10 (SPSS Inc., Chicago, IL) was used for all analyses.

  judgment to reduce possible type 1 error. STATA 8.0 (College Station, TX) was used to analyze the data.

• Adjusting alpha level for multiple statistical tests
disease severity in adjusted models. We used the Bonferonni correction to adjust for multiple comparisons in our primary analyses. The Bonferonni-adjusted threshold for statistical significance was \(P \leq .005\). SAS version

• Clearly state the dependent and independent variables used in your statistical analyses
Results

• Reporting descriptive data
• Standard deviation or standard error
• Reporting missing data
• P-values, effect size, confidence interval
Reporting Descriptive Data

• Numerical data should be rounded when presented; however, not when analyzed.

• When citing a percentage, always include the numerator and denominator of the calculation.

• When citing a rate, ratio, proportion, percentage, always include the denominator.

• Better not to use the ± symbol when presenting mean and standard deviation; for normally distributed data:
  - we expect 68% of the data to lie within ±1 SD
  - we expect 95% of the data to lie within ±2 SD
Reporting Descriptive Data

• Avoid using percentages to summarize small samples.
  – if appropriate, present all data values (if small sample size)
• If reporting a measure of risk and describing as low, medium, high, etc, be sure these are well defined.
• Always include unit of measurement for all variables in your study (including time).
• Report your primary analyses before presenting any secondary results.
Reporting Descriptive Data

• Report measurements only with as much precision as needed
  -usually 2 significant digits is adequate
• When using descriptive statistics to summarize continuous data, always report (i) measure of central tendency, and (ii) measure of dispersion
  -if data are approximately normally distributed:
    * Report (i) Mean and (ii) SD
  -if data are non-normal or small sample size:
    * Report (i) Median and (ii) Interquartile Range
Standard deviation or standard error?

Depends on the purpose:

- Standard deviation (SD) for descriptive purposes
- Standard error (SE) for inferences about underlying population or comparing subgroups with different sample sizes

Compare:

- Mean weight of a sample of 100 men is 72 kg and SD is 8 kg
- Estimated mean is 72 kg ± 1.6 (2 SEs) or 95%CI for the mean weight is 70.4 to 73.6 kg (range of plausible values for mean)
Reporting Missing Data

• Quantify the amount (range of percents), reasons for, and type of missing data
  – Missing completely at random (MCAR)
    \[ P(Y \text{ is missing} | X, Y) = P(Y \text{ is missing}) \]
  – Missing at random (MAR) – Ignorable
    \[ P(Y \text{ is missing} | X, Y) = P(Y \text{ is missing} | X) \]
  – Not missing at random (NMAR)
    Requires model of missing data mechanism

• Depending on the type and amount of missing data: ignore (but acknowledge), single-value imputation, multiple imputation, models for missing data
(Mis)use of P-values

• Always report the p-value (do not use ‘NS’)
  – even if not significant
  – If smaller than 0.001, cite as <0.001 (do not cite p=0.0000).

• A non-significant result only means the results are inconclusive; this is not the same thing as concluding ‘no difference’ or ‘no effect’.

• Present the “effect size” not just the p-value.

• p-values do not give strength of an association.
• p-values do not give a ‘trend towards significance’ and cannot be ‘marginally significant’.

  It is invalid, bad science, nonsensical, wrong to express:
  *p<0.05, **p<0.01, ***p<0.001, ****p<0.0001
Presenting Final Results

Look at differences between the statements below. What is the best way to describe the results?

1. “The effect of the drug is statistically significant”.
2. “The effect of the drug on lowering diastolic blood pressure was statistically significant (P<0.05)”.
3. “The mean diastolic blood pressure of the treatment group dropped from 110 to 92 mmHg (P = 0.02)”.
4. “The drug lowered diastolic blood pressure by a mean of 18 mmHg, from 110 to 92 mmHg (95%CI = 2 to 34 mmHg; P = 0.02)”.

Absence of Evidence Is Not Evidence of Absence

• Example 1 of HIV-1 transmission trial.
  Results showed incidence ratio of HIV = 1 for intervention compared to control group. However, the 95%CI was (0.63, 1.58). Summarizing by saying that the intervention has no effect is misleading. The CI indicates that values of decreasing transmission by 37% as well as increasing transmission by 58% are plausible. Clearly, more data are needed to distinguish between the 2 possibilities.

• Example 2: A small study of 10 patients might report an estimate of the correlation between 2 variables to be 0.5 (pretty high), but not significant. It is again worthy of additional study.

What statistical significance does not mean?

• When the null hypothesis can be rejected at some level, $\alpha$, there is good evidence that an effect (or difference) is present.

• But the difference (effect) can be very small

Example:

We look at a correlation between 2 continuous variables. With 400 observations, the sample correlation coefficient, 0.1, is significant at 5% level (that is, we reject null hypothesis of no correlation). However, for practical purposes 0.1 is not a very strong correlation, so we might ignore this significant result.
Figures
Figures

• Provide a visual display of measured quantities

• Type of data reduction

• Represent an arranging of information

• Aid to make sense of information

• Can be used to make decisions

• Figures are only as good as the data that go into them!
Figure Guidelines

• Figures should:

  – Show the data

  – Serve a clear purpose and **be understandable at a glance**

  – Align with the statistical and verbal descriptions of the data

  – Summarize many numbers coherently

  – Focus on the message to be conveyed to the viewer
Figures: Example

• This example summarizes survey data collected in a convenience sample of JHU SON students

• The survey included questions about the following:
  • Psychological type: *feeling, thinking, intuitive, sensitive*
  • Having a facebook account: *yes, no*
  • Average number of hours of sleep per night
Figures: Example - Before

Default options in Microsoft Excel

![Default options in Microsoft Excel](attachment:image.png)
Figure Changes

– Decrease clutter: gridlines, tick marks
– Increase readability with font size
– Match y-axis more closely to range of data
– Include measure of dispersion with central tendency
– Label axes
– Units of measure
Figures: Example - After

Average Sleep per night (hours)

<table>
<thead>
<tr>
<th>Psychological type</th>
<th>feeling</th>
<th>thinking</th>
<th>intuitive</th>
<th>sensitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>facebook</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>nofacebook</td>
<td>6</td>
<td>5</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

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Another Example Figure

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Figures Checklist for your Manuscript


• Is the figure necessary?
• Is the figure simple, clean, and free of extraneous detail?
• Is the lettering large and dark enough to read? Is it a good size?
• Are parallel figures prepared according to the same scale?
• Are all abbreviations and symbols explained in a figure legend or figure caption?
• Is the figure mentioned in the text?
Tables
Table Guidelines

• Tables:
  – Should be able to stand alone
  – Do not need to read the text to grasp the table message
  – Be interpretable at a glance
  – Display data or statistics
  – Make use of borders, font, spacing, to make your point.
Table Guidelines

• Sometimes a table is not appropriate:
  – Less than 6-8 values
  – Information in the table can easily be summarized in a few sentences
  – Same data are presented as a graph
  – Point is better made with a graph
Table 1. Summary statistics for depression score by age group

<table>
<thead>
<tr>
<th>Age:</th>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>Males:</th>
<th>Females:</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-12 years</td>
<td>25</td>
<td>45.78</td>
<td>3.30</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>13-19 years</td>
<td>15</td>
<td>27.65</td>
<td>8.26</td>
<td>15</td>
<td>52</td>
</tr>
<tr>
<td>20-29 years</td>
<td>33</td>
<td>11.07</td>
<td>4.03</td>
<td>33</td>
<td>91</td>
</tr>
</tbody>
</table>
Table Changes

- Eliminate redundancy of column and row labels
- Eliminate redundancy of statistics and units labeling
- Eliminate redundancy by merging column headers
- Limit significant digits
- Center align numbers
- Separate title from table
- No vertical lines; limit other separators
Table 1. Summary statistics for depression score by age group

<table>
<thead>
<tr>
<th>Age Range (years)</th>
<th>Males</th>
<th></th>
<th>Females</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean (SD)</td>
<td>n</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>8 - 12</td>
<td>25</td>
<td>45.78 (3.31)</td>
<td>12</td>
<td>38.34 (6.37)</td>
</tr>
<tr>
<td>13 – 19</td>
<td>15</td>
<td>27.65 (8.26)</td>
<td>52</td>
<td>20.04 (7.15)</td>
</tr>
<tr>
<td>20 – 29</td>
<td>33</td>
<td>11.07 (4.03)</td>
<td>91</td>
<td>8.24 (5.17)</td>
</tr>
</tbody>
</table>
### Table 1. Summary statistics for depression score by age group

<table>
<thead>
<tr>
<th>Age Range (years)</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
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</tr>
<tr>
<td>8 - 12 years</td>
<td>25</td>
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</tr>
<tr>
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<td>15</td>
<td>27.65 (8.26)</td>
</tr>
<tr>
<td>20 – 29 years</td>
<td>33</td>
<td>11.07 (4.03)</td>
</tr>
</tbody>
</table>
Tables Checklist for your Manuscript


- Is the table necessary?
- Are similar tables in the manuscript consistent in formatting and presentation?
- Is the title brief but explanatory?
- Does every column have a column heading?
- Are all abbreviations, special use of italics, parentheses, and dashes, and special symbols explained?
- Is the table referred to in the text?
### Table 1. Associations between respondents’ demographic characteristics and self-reported willingness to respond (WTR) to a pandemic flu emergency

<table>
<thead>
<tr>
<th></th>
<th>WTR if required</th>
<th>WTR if asked, but not required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% *</td>
<td>% Agree b</td>
</tr>
<tr>
<td>All d</td>
<td>82.5</td>
<td>Reference</td>
</tr>
<tr>
<td>By respondent characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>72.7</td>
<td>81.6</td>
</tr>
<tr>
<td>Male</td>
<td>27.3</td>
<td>84.9</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>16.5</td>
<td>80.6</td>
</tr>
<tr>
<td>30-39</td>
<td>21.8</td>
<td>79.8</td>
</tr>
<tr>
<td>40-49</td>
<td>25.7</td>
<td>82.2</td>
</tr>
<tr>
<td>50-59</td>
<td>27.0</td>
<td>85.1</td>
</tr>
<tr>
<td>60+</td>
<td>9.0</td>
<td>84.3</td>
</tr>
<tr>
<td>Duration at JHH e</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1</td>
<td>11.0</td>
<td>81.3</td>
</tr>
<tr>
<td>1-5</td>
<td>32.5</td>
<td>82.8</td>
</tr>
<tr>
<td>6-10</td>
<td>17.3</td>
<td>80.1</td>
</tr>
<tr>
<td>&gt;10</td>
<td>39.2</td>
<td>83.5</td>
</tr>
</tbody>
</table>

* Percent of respondents in category within characteristic
b Percent agreeing with WTR statement (positive response)
c OR is the odds ratio provided in the logistic regression which compares the odds between a positive WTR response and a negative WTR response with respect to a particular characteristic category compared to its reference category, adjusted for other demographic characteristics.
d Percent covers all respondents.
e Johns Hopkins Hospital (JHH)
Tables: Annotations

Table 2. Relative Risks for Preeclampsia in Women With Diagnosed Depression Exposed to Antidepressant Classes During Gestational Weeks 10–20 Versus Unexposed Women, British Columbia Health-Care Utilization Data, 1997–2006

<table>
<thead>
<tr>
<th>Exposure Group</th>
<th>No.</th>
<th>Preeclampsia, %</th>
<th>Model 1 95% CI</th>
<th>Model 2 95% CI</th>
<th>Model 3 95% CI</th>
<th>Model 4 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSRI monotherapy</td>
<td>3,169</td>
<td>3.3</td>
<td>1.47 (1.20, 1.81)</td>
<td>1.47 (1.19, 1.81)</td>
<td>1.16 (0.92, 1.45)</td>
<td>1.22 (0.97, 1.54)</td>
</tr>
<tr>
<td>SSRI polytherapy</td>
<td>333</td>
<td>4.5</td>
<td>2.04 (1.21, 3.46)</td>
<td>1.76 (1.03, 3.01)</td>
<td>1.31 (0.76, 2.27)</td>
<td>1.28 (0.73, 2.22)</td>
</tr>
<tr>
<td>SNRI monotherapy</td>
<td>408</td>
<td>5.6</td>
<td>2.63 (1.71, 4.04)</td>
<td>2.44 (1.58, 3.77)</td>
<td>1.96 (1.26, 3.03)</td>
<td>1.95 (1.25, 3.03)</td>
</tr>
<tr>
<td>TCA monotherapy</td>
<td>146</td>
<td>9.6</td>
<td>4.29 (2.45, 7.50)</td>
<td>3.69 (2.12, 6.41)</td>
<td>3.47 (2.00, 6.02)</td>
<td>3.23 (1.87, 5.59)</td>
</tr>
<tr>
<td>No antidepressant</td>
<td>65,392</td>
<td>2.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: CI confidence interval; RR, relative risk; SNRI, serotonin-norepinephrine reuptake inhibitor; SSRI, selective serotonin reuptake inhibitor; TCA, tricyclic antidepressant.

a Model 1: adjusted for delivery year.
b Model 2: adjusted for delivery year, age, diabetes, multifetal gestation, obesity, primiparity, and physician visits.
c Model 3: adjusted for delivery year, number of depression claims, number of psychiatrist visits/mental health hospitalizations, and dispensing of benzodiazepines, anticonvulsants, and antipsychotics.
d Model 4: adjusted for the covariates in model 2 and model 3.
References


Additional References

http://www.jic.ac.uk/services/statistics/readingadvice/booklets/toptgs.html

http://en.wikipedia.org/wiki/Misleading_graph

http://www.acponline.org/residents_fellows/competitions/abstract/prepare/table_poor.pdf
Main Points

• Present a measure of variability with the measure of central tendency
• Don’t ignore missing data!
• Check statistical assumptions
• Present “effect size” with p-values; present CIs.
• Absence of evidence is not evidence of absence!
• Clinical vs. Statistical significance
• Summarize data in clean, precise, coherent way
• Good research deserves to be presented well and part of good research is good presentation.
Acknowledgements

Dr. Matthew Hayat, Rutgers University and Dr. Gayane Yenokyan for access to their slides.