



Clinical Trial Research News

From the Office of Clinical Research

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This newsletter is published on a bi-monthly basis and is designed to provide an information source for anyone interested in Clinical Research. Please contact Trish Berry if you would like to be added to / deleted from our mailing list.

Statistics and Medical Research

Doug Staley teaches statistics at the School of Medical Rehabilitation, University of Manitoba and has conducted medical research at SBGH for more than 25 years. Readers are welcome to submit questions or suggest topics of interest. Doug can be contacted through the OCR or by email: dstaley@mts.net or extension 2690.

Statistics and Medical Research

Statistical Presentation of Numerical Data

The quality and standard of the statistical presentation of data in manuscripts submitted for publication in medical journals has been criticized by statistical experts (1, 2). The major areas of concern involve study design, presentation of data, statistical analysis and interpretation of results.

Some of the identified problems are relatively minor errors of omission but a sizeable proportion are more serious errors of commission which cast doubt about the study's results and conclusions. The purpose of the present article is to alert researchers to common errors in the reporting of numerical data and provide guidelines for proper presentation. For a more detailed discussion of this topic readers are referred to the review article by John Bailar and Frederick Mosteller (3).

Study Design

- o The choice of study design should clearly reflect the purpose of the study. The purpose and the primary and secondary hypotheses of the study should be clearly presented.
- o The reasons for selecting the particular sample of participants should be delineated. The sample size should be determined, whenever possible, by a statistical power calculation.
- o In randomization studies the mechanism of randomization and blinding should be adequately described.

Statistical Sections in the Manuscript

- o Details of the specific statistical analyses performed and the rationale for the choice of statistical tests should be indicated in the Method section of the manuscript under the heading "Statistical Analysis."
- o In some instances descriptions of a follow-up statistical analysis based on the results of the initial analysis are better included in the Results section.
- o Standard statistical tests such as the t-test or Chi-square test do not have to be referenced, but more obscure tests should be referenced by a citation from the literature. Where possible references for study design and statistical methods should be standard texts rather than journal papers.
- o The name of the computer programs used to analyze the data should be provided, including the version number, e.g. SPSS (12.0).
- o Many statistical terms, such as sample, random, normal, significance, correlation and association are derived from everyday language. In statistics these technical terms have a very precise meaning and should be used carefully in the body of the text.

Spurious Accuracy

- o When reporting numerical data spurious precision with many decimal places should be avoided (e.g. $t = 3.14592$). Such spurious precision is unnecessary and often suggests uncritical transcription of computer printout results to the manuscript.
- o As a general rule, percentages should be presented as integers when sample sizes are less than 100. For larger samples percentages should be reported to one decimal place.
- o Sample means and standard deviations should be expressed to one more significant figure than was used for the original measurements of the variable (e.g. heart rate = 72, 64, 69, etc, then the mean heart rate = 68.3).
- o The units in which the variables are measured (e.g. mg) should be clearly specified in the text.

Probability Values

- o The reporting of the results of statistical tests should include both the value of the test statistic and the associated probability value (e.g. $r = +.73$, $p = .006$).
- o The actual p-value should be given to 2 or 3 decimal places rather than reporting $p < .05$ or $p < .01$. However, if a result is highly significant, it is sufficient to state $p < .001$ rather than providing the actual value (say $p = .000002$).
- o When the result of a statistical test is non-significant, the actual p-value should be reported rather than just stating "n.s."
- o Where multiple comparison are applied in a statistical analysis it is important to make an appropriate adjustment to the p-values (e.g. Bonferonni correction) to control for Type I (false positive) errors.
- o Significance levels should not be reported by themselves and should be accompanied by measures of effect size (e.g. differences between group means) or confidence intervals.

Assumptions of Statistical Tests

- o All statistical tests are based on a number of underlying assumptions which must be met if the analysis is to be properly conducted. For instance, most statistical tests assume that the

observations being analyzed are independent. This assumption is violated in a study where multiple observations (e.g. four tissue samples) are collected from each subject.

- o When comparing means between two groups a paired t-test is appropriate when the groups are related or matched and an unpaired t-test when the groups are independent.
- o Both the t-test and Analysis of Variance (ANOVA) procedures require an approximately normal distribution of scores and homogeneity of variance among groups.
- o Authors should specify whether they are using one-tail (directional) or two-tail (non-directional) statistical tests.
- o The number of statistical tests applied to the analysis of the data should be limited as much as possible to the essential analysis of the primary hypotheses of the study.

Normal and Skewed Distributions

- o Reporting the mean and standard deviation of continuous variables is only appropriate when the distribution of scores is approximately normal and symmetrical. Figure 1 shows the relative placement of the mean, median and mode for normal, positively skewed and negatively skewed distributions.

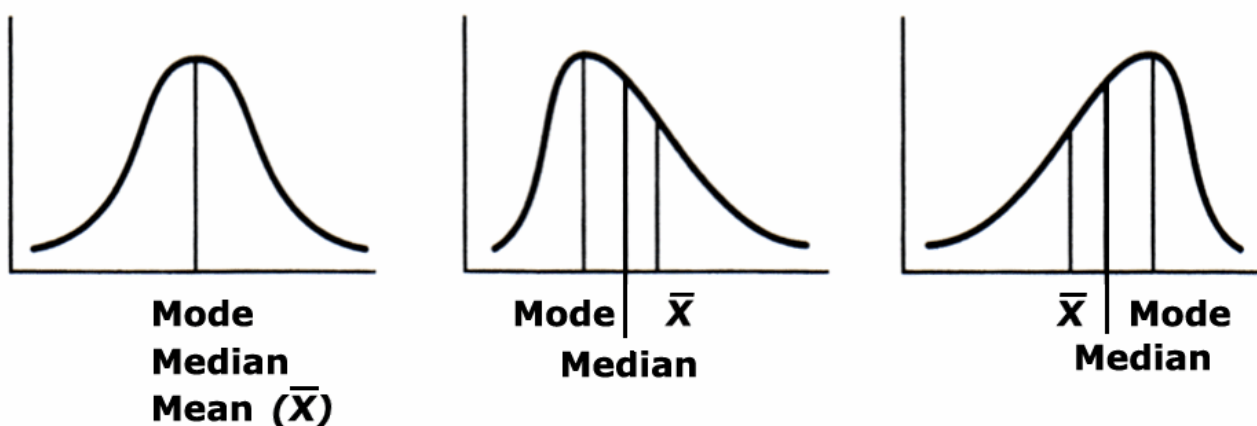


Figure 1

- o When distributions are skewed (the majority of scores at the low end or upper end) the median is a more appropriate measure of central tendency than the mean.
- o For skewed distributions the interquartile range is better than the standard deviation as a measure of variability.
- o The range of scores should not be the sole measure of variability. The range depends on the sample size and the two most extreme observations may be the least reliable.

Standard Deviation and Standard Error

- o A common statistical error in medical research is confusing the standard deviation (SD) with the standard error of the mean (SE). SD is the variability among observations. For variables with a normal distribution, roughly 95% of the values lie within 2 SDs of the mean, independent of the sample size.

- o SE is the variability among sample means drawn from a known population. It is a measure of the precision with which a sample statistic (such as a sample mean) estimates the population parameter. The precision of the estimate depends on the sample size: a small sample leads to a large SE and a large sample to a small SE.
- o The 95% confidence interval (CI) specifies values for the sample statistic within a range of plus or minus two SEs from the population parameter (Figure 2). Whenever possible CIs should be reported by the researcher when testing hypotheses concerning population parameters.

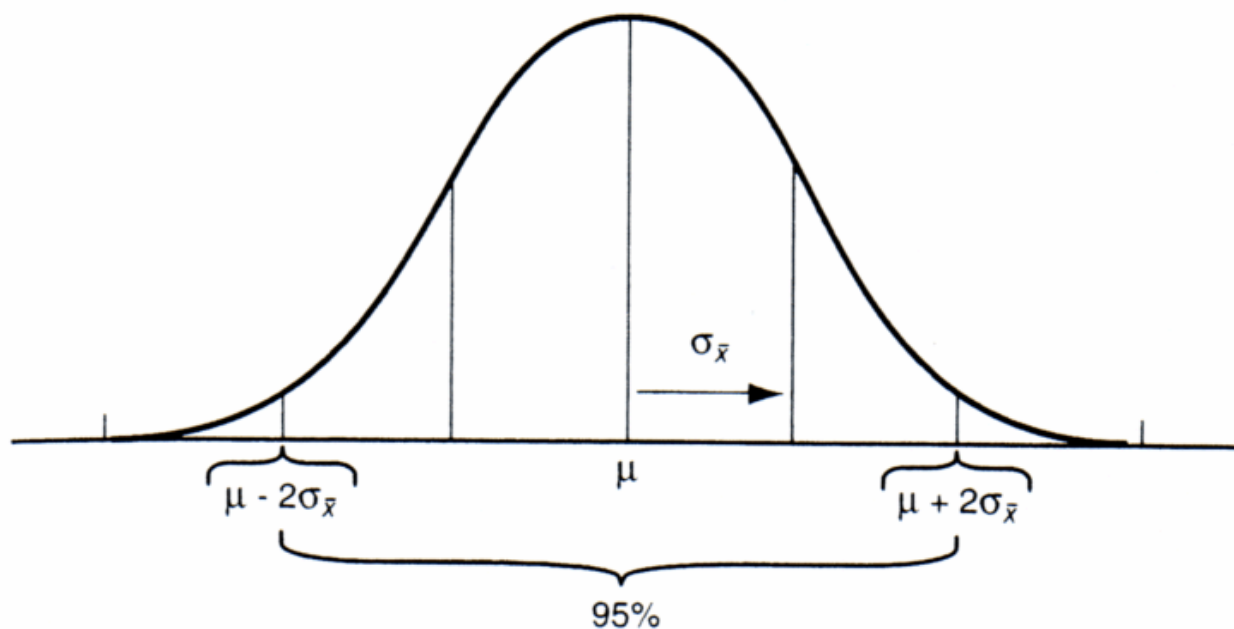


Figure 2

Interpretation

- o Statistically significant findings do not necessarily imply causality unless the study is a controlled randomized trial. For instance, a significant correlation coefficient suggests an association between two variables rather than a causal relationship.
- o Statistical significance based on probability testing does not directly equate with clinical relevance. Confidence intervals should be presented in order to assess clinical relevance especially when interpreting "negative" findings.
- o The primary emphasis of the study findings should be based on testing the study hypotheses and secondary analyses should not be unduly emphasized.

References

- (1) G.D. Murray "Statistical Guidelines for the British Journal of Surgery." *British Journal of Surgery*, 1991, 78, 782-784.
- (2) Douglas Altman "Statistics in Medical Journals: Some Recent Trends." *Statistics in Medicine*, 2000, 19, 3275-3289.
- (3) John Bailar and Frederick Mosteller "Guidelines for Statistical Reporting for Medical Journals: Amplifications and Explanations." *Annals of Internal Medicine*, 1988, 108, 266-273.

This article is authored by OCR statistical consultant Doug Staley. Doug teaches statistics at the School of Medical Rehabilitation, University of Manitoba and has conducted medical research at SBGH for more than 25 years. Readers are welcome to submit questions or suggest topics of interest. Doug can be contacted through the OCR or by email: dstaley@mts.net or extension 2690.



SoCRA Exam – Saturday May 12, 2007 – St. Boniface General Hospital, Room NG034

The Society of Clinical Research Associates, Inc. (SoCRA) is a non-profit, professional organization dedicated to the continuing education and development of clinical research professionals. The express aim of SoCRA is to provide training and continuing education for clinical research professionals and to establish and maintain an international certification program for clinical research professionals.

CERTIFICATION EXAM REGISTRATION FOR WINNIPEG IS NOW CLOSED.

For those who have registered directly with SoCRA you are reminded that the exam date is Saturday, May 12/07 - 10 AM to 2 PM at St. Boniface General Hospital.

You will be contacted directly by Terry Sawicz-Hanesiak by the end of April to confirm the location and parking availability at St. Boniface General Hospital.

Research Review Committee at St. Boniface Hospital

| <u>Deadlines for RRC Submission</u> | <u>Meeting Date</u> |
|--|----------------------|
| April 25 th | May 2 nd |
| May 30 th | June 6 th |
| PLEASE NOTE THERE IS NO MEETING IN JULY | |

The Biomedical (BREB) / Health Research Ethics Board (HREB) Submissions

| <u>Deadline for REB Submissions</u> | <u>Meeting date</u> |
|-------------------------------------|------------------------|
| April 16 th | April 30 th |
| May 14 th | May 28 th |

Contact **Ethics** at **789-3255** with any questions you may have regarding your REB submission. Noreen is available to assist you with consent form development and the submission process. Please always refer to the Research Ethics Board web site for the most recent submission forms and updates.

Upcoming Workshops

Project and Documentation Management for Clinical Research - Tuesday, May 8, 2007

Rules, Roles and responsibilities will serve as the basis for project and documentation management of clinical research studies, be they drug, device or outcomes research. Topics covered will be:

- Pre-Study Planning, REB and Institutional Approvals
- Study Documents (Protocol, ICF, etc.)
- Source Documents and Data Collection Forms
- Informed Consent Process, Subject visits, Study Close out

Facilitators: April Hughes, Administrator Director
Terry Sawicz-Hanesiak, Regulatory Affairs/Quality Assurance
Office of Clinical Research
St. Boniface General Hospital

Date/Time: Tuesday, May 8, 2007, 1330 – 1530 hrs

Location: Room N1012 – Theatre A
Education Building (431 Tache), St. Boniface General Hospital (409 Tache Ave)

Cost: FREE

Registration: Call Terry Sawicz-Hanesiak 237-2226 or e-mail tsawicz@sbgh.mb.ca



Good Clinical Practice Workshop – Wednesday May 9, 2007- Workshop is Full

Please contact Terry to add your name to the mailing list to be notified of possible future workshops dates.

Terry Sawicz-Hanesiak, SBGH – Office of Clinical Research
(204) 237-2226 or e-mail tsawicz@sbgh.mb.ca

HISP Update

HISP has arrived! Some training sessions are being offered in later April and early May, after which training will only be available as part of the Hospital Orientation schedule. At this point, we are hoping that everyone will have received their training and their passwords. The system is so convenient that you will be able to access records via your desk top, so this should prove a valuable tool for doing your work!

In addition to your own trouble shooting with the help provided by the EPR Service Desk (940-8500) please let April know if you have any comments and feedback on the system.

Good luck!

Found Resources

The Canadian Health Services Research Foundation (CHSRF) promotes and funds management and policy research in health services and nursing to increase the quality, relevance and usefulness of this research for health-system policy makers and managers. In addition, the foundation works with these

health-system decision makers to support and enhance their use of research evidence when addressing health management and policy challenges. Any foundation project, process or activity always involves both researchers, and managers, policy makers from academia and Canada's health system.

CHFRS has launched a web page resource of tools to help organizations create, share, and use research and welcomes you to their new free online database of resources for health services organizations that wish to use research better.

http://www.chsrf.ca/knowledge_transfer/tools_e.php