

Survival Skills for Researchers

Literature Review

Proposals

Manuscripts

LITERATURE REVIEW

Goals

- To conduct a comprehensive search using pre-defined search strategy
- To identify all relevant published work
- To prepare quality review for thesis, proposal, manuscript

Steps

- Identify sources and define search terms
- Search sources and identify relevant work within search results
- Track down and read articles
- Summarize each article
- Write critical review

Sources

What type of information will you use?

- Published reports
 - Original research reports
 - Reviews
 - Book chapters
 - Proceedings from meetings
- Unpublished works, internet sites?

Sources

Potential places to search

- Electronic databases (use >1)
- Key journals
- Reviews, chapters
- Colleagues, advisors

Search Terms

- Break your research question into component parts
 - General topics on importance of overall scientific problem
 - Specific topics from your research question
- Write down search terms for both
 - Study relevant articles for keywords
 - Combine certain search terms

Search

- Search several electronic databases
 - Get help from librarian
 - Enter appropriate terms
 - Combine to narrow (Boolean operators)
- Perform “manual” search of citations in reviews and chapters
 - Note that there could be citation bias

Search

- Ask colleagues and advisors
 - Ask for primary resources (often missed by electronic search if before 60's)
 - Can be efficient but can also be biased
- Use your own experiences
 - Read field journals regularly
 - Attend meetings

Track Down Articles

- Compile a working bibliography
- Find copies of articles
 - Online
 - From library
 - From colleagues

Summarize Articles

Evaluate and take notes on

- ❑ Research question
- ❑ Methods
- ❑ Results
- ❑ Validity of conclusions
- ❑ Relevance of results/conclusions to your research question (“sound bite”)
- ❑ Citations (new ones you can use?)

Write Critical Review

Purposes of critical review/background section of thesis, proposal, manuscript

- ❑ To show readers/reviewers that you have a good grasp of subject
- ❑ To demonstrate that what you propose is important
- ❑ To demonstrate that what you propose is new

Responsible Conduct

- Be systematic -- find all relevant publications
- Synthesize previous work with no bias
- Only cite papers you have read
- If you are citing original work, use original report not review

“Disregard Syndrome”*

Lack of regard for already published findings

- “Old” scientific findings not available through electronic sources
- Intentional disregard

*Garfield, *The Scientist*
Ginsburg, *The Scientist*

Plagiarism

- Use of another person's words or ideas without giving credit
- Acceptable practices
 - State finding from original report by paraphrasing & giving appropriate citation
 - Quote a statement (use quotation marks) & give credit

Plagiarism

- Questionable practice?
 - Re-work someone's idea without giving credit
 - Copy a paragraph verbatim preceded by "____ found the following results."
- Misconduct
 - Copy paragraph verbatim without credit

PROPOSALS

Proposal

Definition of a “proposal”: An offer proposing something to be accepted

- Something = Research plan
- Acceptance = Chance to get degree, funding, job position

Think of proposal writing as an opportunity

Purpose of a Written Proposal

To portray

- Your good ideas
- Logic and suitability of design, methods, and analysis
- Contribution to advancement of scientific knowledge, public good, or aims of a company

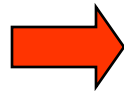
Purpose of a Written Proposal

Also need to present

- Competency of personnel
- Adequacy of research facilities and grantee organization
- Justification for amount of funding requested

Anatomy of a Proposal

- Title
- Abstract
- Budget
- Investigators
- Resources
- **Research plan**
- Bibliography



Specific aims
Literature review
[Preliminary studies]
Research design &
methods

Title (or First Impressions)

- Purpose: To convey information and attract readers
 - Research goals
 - Importance of work
 - Key words and term
- Conform to guidelines

Titles

Examples

- 1R03AG15197 BRAND, RICHARD
DOES OSTEOPOROSIS ALTER BONE
CELL RESPONSE TO STRAIN?
- 5P01AG05793 BURR, DAVID
EFFECT OF SUPPRESSED BONE
TURNOVER ON SKELETAL FRAGILITY

Abstract or Summary

Purpose: To provide accurate description of project when separated from proposal

- Government agencies make abstracts of funded projects public
- Private Foundation/Company may use in annual report

Abstract Instructions

HST MEMP Thesis Proposal

“The abstract should include: 1) a condensed description of the background and significance, explaining why the work is important, 2) the specific aims of the proposal, and 3) a summary of the methods to be used to accomplish the specific aims. Headings within the abstract (Background, Specific Aims, and Methods) are optional. The maximum length is 300 words.” *HST Student Handbook*

Abstract

Try to include:

- Rationale/background
 - 2-4 sentences
- Hypotheses and specific aims
 - 2-4 sentences
- Proposed methods
 - ≤ 5 sentences
- Closing sentence about interpretation and importance of results

Abstract

- Make it interesting (but not too provocative)
- Try to tell a story (albeit a short one)
- Follow instructions
- Write after bulk of proposal is written
- Make each sentence lead into next
- Write for public consumption
- Do not include proprietary information

Research Plan

Purpose: To portray

- What do you intend to do?
 - Hypotheses and Specific Aims
- Why is it important?
 - Significance/Rationale/Background
- How are you going to do it?
 - Design and methods

Specific Aims

- In each *Specific Aim*, address, in practical terms, approach to test hypothesis
 - Describe what you will do to test hypothesis
 - State specimens, variables, methods, and sometimes even statistical analysis

Specific Aims

- Try to write in one page
- Use present tense for hypotheses and future tense for specific aims
- Write first
- Share with peers & advisors for criticism

Background

Build solid justification for proposed research:

- What is the general problem
- What is the impact of the problem
- What is known
- Which uncertainties you will address
- How will addressing these uncertainties advance scientific knowledge

Background

Composition

- Write for informed reader but not expert
- Use strong topic sentences
 - Pull out topic sentences – should tell entire story
- Focus on ideas not authors (make citations parenthetical)
 - Do not use “Myers et al. found ...”
 - Do use “Bone mineral density of the spine was a strong correlate with vertebral strength (Myers et al...)”

Design and Methods

- Longest, most important section
- No one organization fits all projects
- For many hypothesis-driven studies (experiments, clinical trials)
 - Start with “Overview” of study design
 - Then organize “Methods” according to Specific Aims

Design and Methods

For each Aim

- Reiterate hypothesis/specific aim
- Describe specimens
- Describe variables to be assessed and methods for measurement (particularly new methods)
- Present plans for analysis and interpretation of results

Design and Methods

To describe data analysis:

- Describe major independent and dependent variables
- State statistical hypotheses a priori
- Describe appropriate statistical test; give reference if uncommon
- Give brief description of interpretation
- Provide enough information for competent colleague to reproduce analysis

Design and Methods

Justify number of laboratory animal or human subjects

- Present results of power analysis
- Illustrate that enough data will be collected to support proposed analysis

Design and Methods

At end of Design and Methods, describe

- Potential difficulties and limitations
- Alternative approaches
- Timetable
- Welfare of animal and/or human subjects

Tips on Clarity and Style

Make appearance conducive to easy reading

- Neat
- White space
- 12 point font

Tips on Clarity and Style

Proofread to avoid

- ❑ Typographical errors
- ❑ Incomplete sentences
- ❑ Incorrect citations
- ❑ Inconsistent headings, font

Tips on Clarity and Style

- Avoid acronyms, abbreviations, jargon
- Use figures and diagrams liberally
- Avoid figures that are hard to read

Successful Proposals

- An idea with impact (significance and innovation)
- Focused hypotheses
- Reasonable specific aims that are directly related to hypotheses
- Innovative, appropriate methods
- Clear path to strong conclusions

MANUSCRIPTS

Examples of Scientific Publications

- Theses
- Abstracts
- Reviews
- Letters to Editors
- Case reports
- Newsletter and newspaper articles
- **Journal articles (peer reviewed)**

Purpose of Journal Article

- Why write a journal article?
 - To communicate research findings at completion of study
 - To put yourself in better position to gain funding or promotion

Aspects of Journal Article

- First disclosure
 - Exception -- prior abstract or poster
- Sufficient information for scientific peers to assess
- Typically reviewed by expert outside of editorial staff (“peer”)
- Available through print medium

Selecting Target Journal

- Select a target journal
 - Scope
 - Readership
 - Length limitation
 - Impact factor
- Obtain and read instructions
- Look at recent issue of target journal for fit and editorial style

Impact Factor

- Frequency with which typical article in journal has been cited
- Definition
 - A = 2002 citations to articles in given journal published during past 2 years (2000-2001)
 - B = total # of articles in journal in 2000-2001
 - **Impact factor = A/B**

Impact Factor

- Can be over longer time (e.g., 5 years)
- Sometimes omit self-citations
- Sometimes omit reviews

Impact Factor

Examples (2001)

□ Cell	29.2
□ Nature	28.0
□ Ann Intern Med	11.1
□ J Bone Min Res	6.2
□ J Biomech	1.9

Structure of Journal Article

- Title page
- Abstract and key words
- Introduction
- Methods
- Results
- Discussion
- Acknowledgment
- References
- Tables
- Figure legends
- Figures

Title

- Purpose
 - To state main topic or outcome of study
 - To interest readers
 - To be found by search software
- Forms
 - Phrase
 - Statement
 - Question - rare

Title: Examples

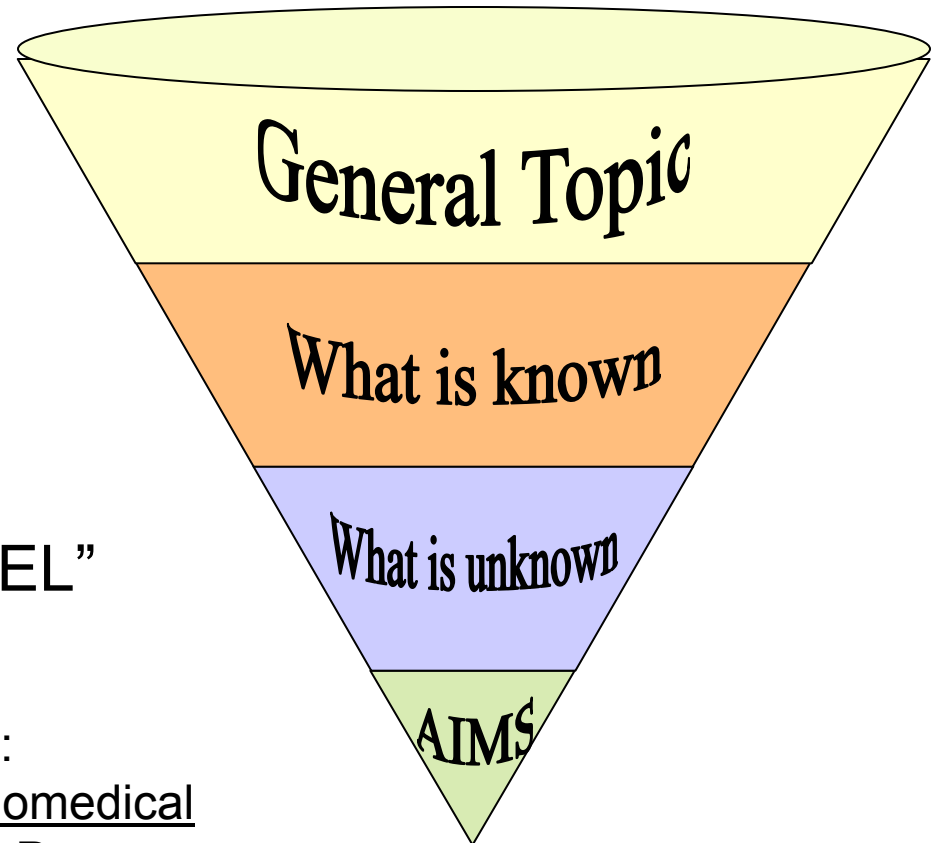
- Clodronate treatment of established bone loss in cardiac recipients [Ippoliti *et al. Transplantation* 2003]
- Risedronate prevents new vertebral fractures in postmenopausal women at high risk [Watts *et al. J Clin Endocrinol Metab* 2003]
- Can vitamin D supplementation reduce the risk of fracture in the elderly? [Meyer *et al, J Bone Miner Res* 2002]

Abstract

- Follow journal instructions
 - Structured versus non-structured
- State
 - Rationale
 - Basic methods
 - Main findings
 - Main conclusions
- 150 – 350 words

Introduction

- Tell a story and build interest
- Prepare reader for what is to come



“FUNNEL”

See:
Zeiger, M:
Writing Biomedical
Research Papers

Introduction

- Summary of what is known
 - Base on thorough literature review
 - Keep it brief and relevant
 - Include key references
- Narrow down to the specific uncertainty that you are addressing

Introduction

Statement of aims

- Put as last section of Introduction
- Make it clear that you are about to state research objectives; provide signal

Examples:

“To determine...”

“Therefore, the objective of this study was ...”

“To test the hypothesis that ..., the following study was ...”

Introduction

- Verb tense
 - Present tense for ideas and statements that exist in the present
 - Past tense for what was done in the past
 - Past tense for objectives
- First person
 - Optional
- Length
 - Approximately 5 paragraphs

Methods

- Provide enough detail for evaluation of protocol
- Describe subjects or specimens
- Define variables and methods of assessment
- Describe statistical approaches
- Indicate approval by institutional committees

Methods

- Organize chronologically
- Report in past tense
- Use figures only if add substantial information
 - Illustrations of equipment
 - Flow charts of protocol

Results

- Describe final set of study subjects or specimens
- Quantify results and present with indicators of uncertainty (often in figures)
- Present results of statistical analyses
- Guide reader through figures and tables that support findings
- Make brief statements of interpretation

Results

- Present important data in figures or tables
- Check internal consistency among text, tables, and figures
- If you have choice of table OR graph, choose graph

Visual Displays of Data

Goals:

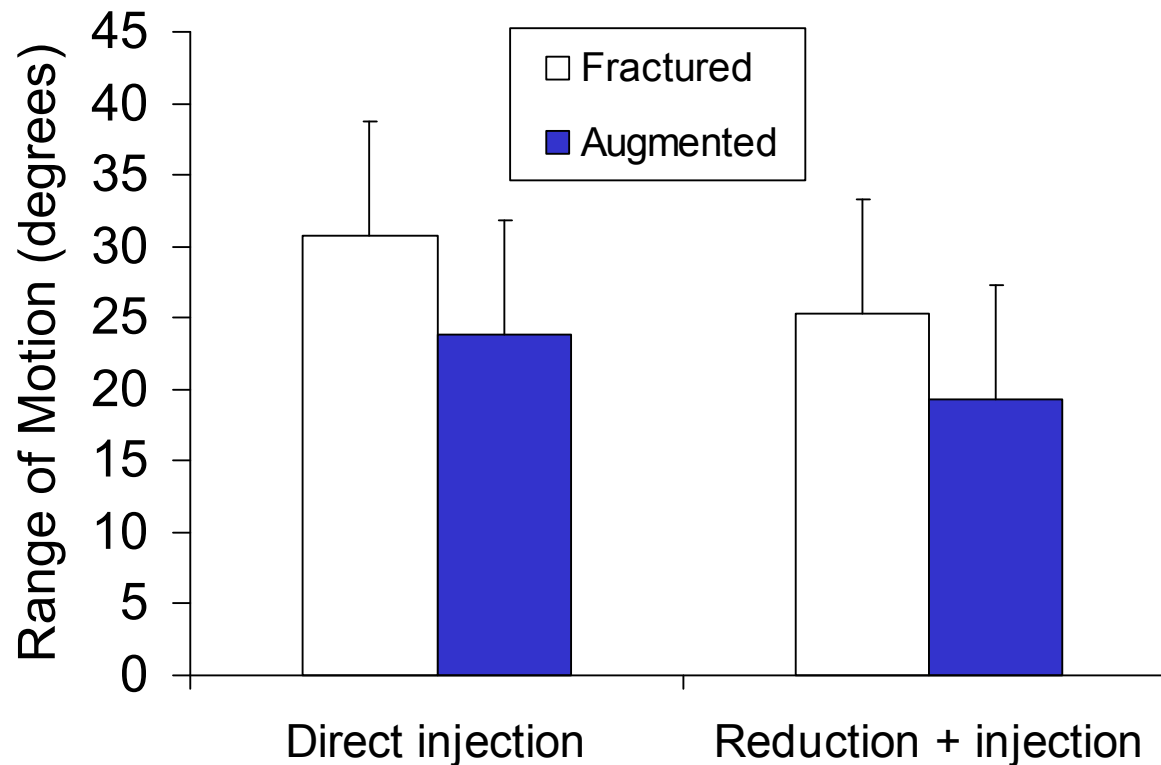
- To display data with visual object (efficient)
- To encourage viewer to compare different sets, see relationships

Graphs

Choose graph that portrays appropriate message

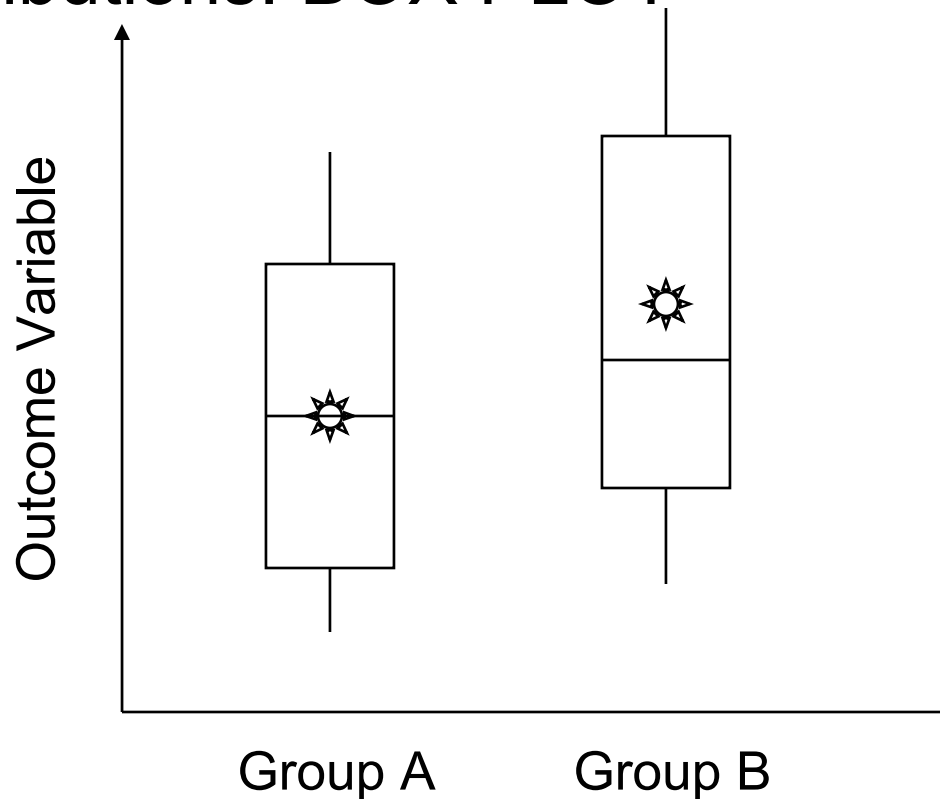
Graphs

To compare parameters among several groups: BAR GRAPH



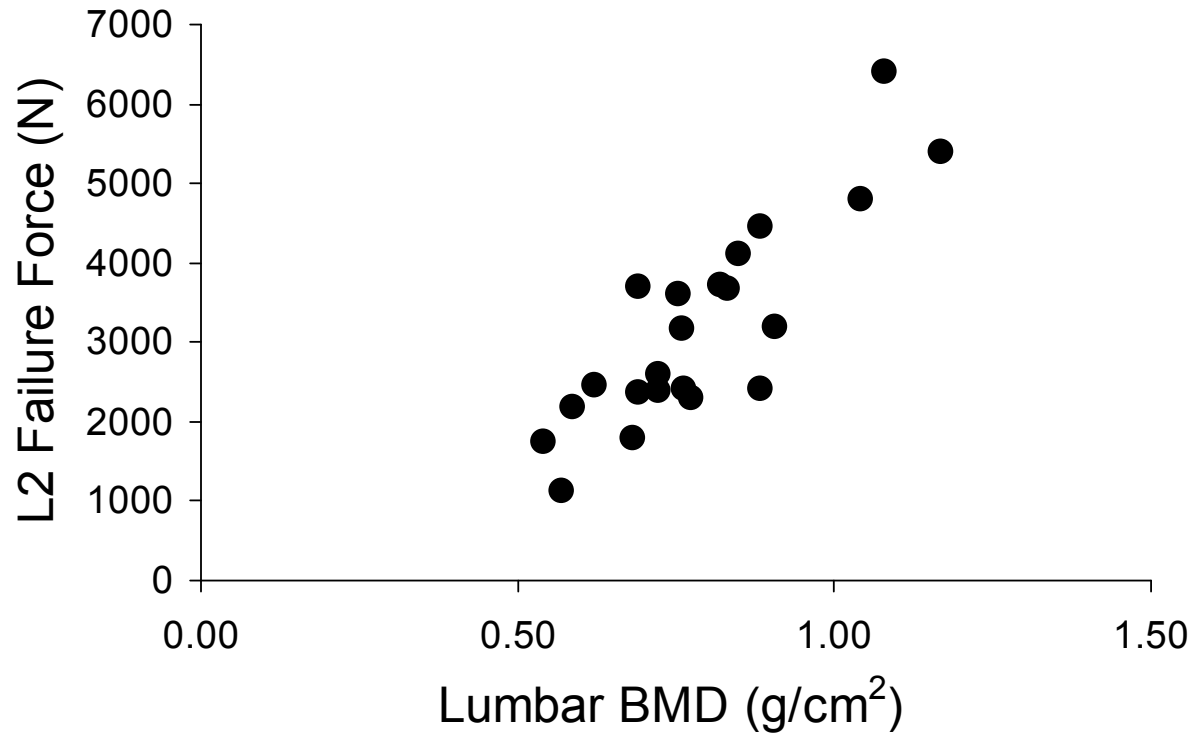
Graphs

To show spread in data and/or to compare distributions: BOX PLOT



Graphs

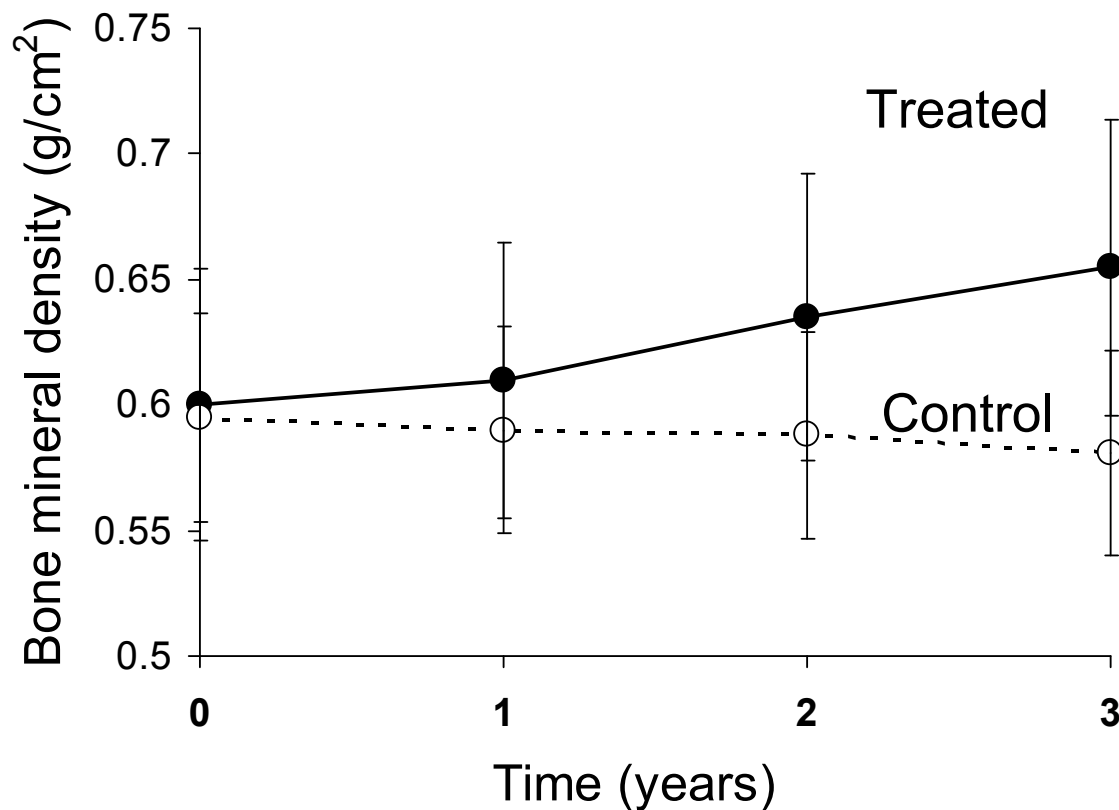
To show relationship between two variables:
SCATTER PLOT



Graphs

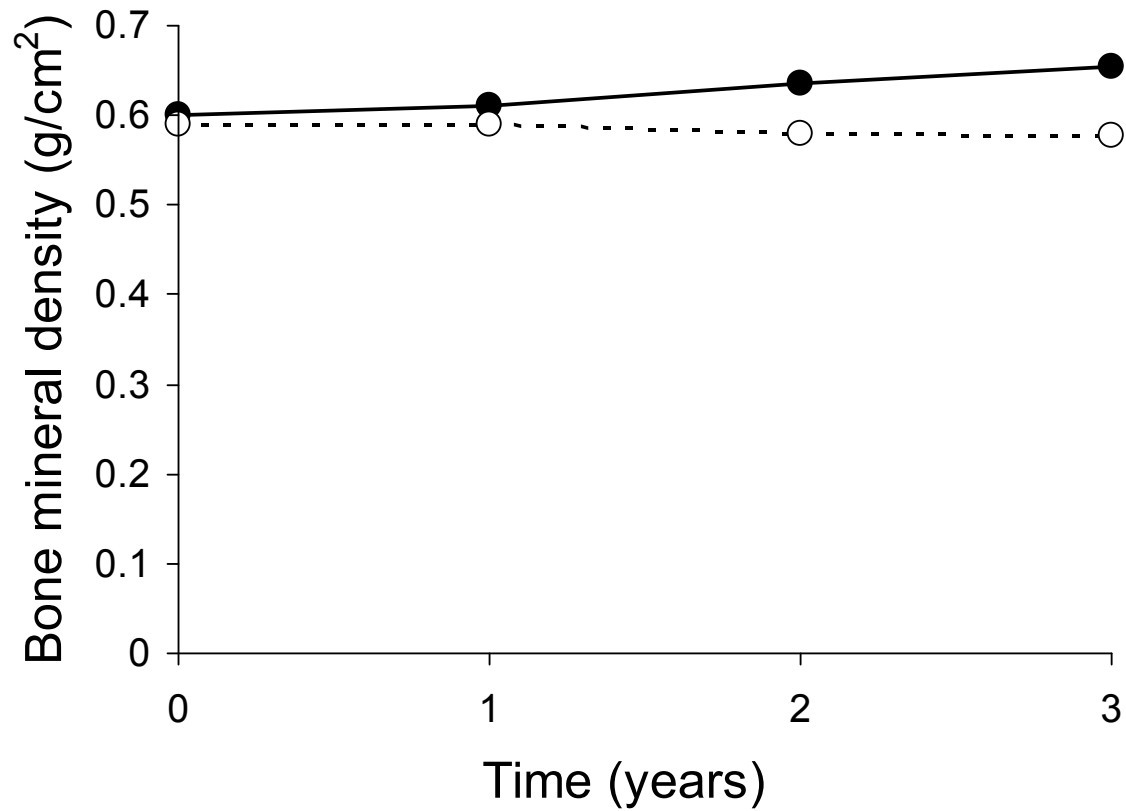
To show change in variable over time:

LINE GRAPH



Graphs

Importance of zero on scale



Tips for Graphs

- Present one main message per graph
- Do not include too much information (confusing)
- Do not waste precious space -- if graph does not contain much information, put message in text
- Do not duplicate data in graphs and tables

Citing Tables and Graphs

- Do not use reference to table or figure as topic sentence, e.g.:
 - Figure 1 shows the results for bone strength.
 - Bone strength increased by 20% in the treated group compared with controls (Figure 1).

Results: Statistics

- Show that assumptions have been met
- Report magnitude of changes or differences in dependent variable with independent variable (often in Figure)
 - Note that “p value” says nothing about size of effect
- Present results of statistical analysis
 - Actual p values

Results: Organization

- Organize chronologically or from most to least important
- Only include results that address stated objectives
- Use past tense

Discussion

Main goals:

- To show that an answer to the research question has been obtained
- To discuss how this answer fits with previous work
- To fully disclose restrictions to interpretation

Discussion

- Rephrase objectives and summarize main findings
- Compare to previous work
- Describe limitations and strengths
- Discuss implications
- Conclude

Acknowledgment

- State:
 - Contributors
 - Sources of support
 - Conflicts of interest or dual commitments
- Note that contributors should give written permission

References

- Follow style of journal
- Use correct journal abbreviation
 - List of Journals Indexed in Index Medicus
 - <http://www.nlm.nih.gov/tsd/serials/lji.html>
- Avoid “unpublished observations” and “personal communication”

Resources

- Garfield E: The impact factor. Curr Contents Jun 20; 253-7, 1994. Available online at <http://www.isinet.com/essays/journalcitationreports/7.html/>
- Ginsburg I: The disregard syndrome: A menace to honest science? The Scientist 15:51, 2001
- International Committee of Medical Journal Editors: Uniform Requirements for Manuscripts Submitted to Biomedical Journals. Available on-line at <http://www.icmje.org>
- Lang TA, Secic M: How to Report Statistics in Medicine, Philadelphia, Am College of Physicians, 1997
- Tufte ER: The Visual Display of Quantitative Information, Cheshire, CT: Graphics Press, 1983 (1997 printing).
- Zeiger M: Essentials of Writing Biomedical Research Papers, New York: McGraw-Hill, Inc., 2nd edition, 2000.