

Writing Your Thesis

I. Preparing to write

A. Review UW Graduate School's *Policy and Style Manual for Theses and Dissertations*

1. Can be downloaded as PDF document from www.grad.washington.edu/stsv/stylman/00stylman.htm
2. 57 pages of detailed (picky?) formatting instructions
3. Nonetheless leaves considerable latitude as to:
 - a. Length of the thesis
 - b. Organization of thesis body (e.g., Introduction / Methods / Results / Discussion)
 - c. Number and placement of figures and tables
 - d. Citation format
4. Can exploit that latitude by tailoring thesis body to format requirements of a scientific journal

B. Should you plan to publish your thesis?

1. Yes.
2. Serves everyone's interests:
 - a. You
 - i. Satisfaction of making a contribution to knowledge on a problem you're interested in
 - ii. Builds your reputation and resume
 - b. The field—gives others the benefit of your work
 - c. UW—advertises the quality and content of the program in which you trained

C. Choose a target journal early

1. Which journal?
 - a. Look again at articles you plan to cite, to see where previous related research has been published
 - b. Get suggestions from thesis committee
 - c. Avoid journals not listed in PubMed
 - d. Among realistic possibilities, opt for journal with more prestige, higher readership. (See [1] for discussion of *journal impact factors* and partial list.)
2. Read target journal's instructions for authors
 - a. Usually gives word limit for whole article and sometimes for sections
 - b. May give guidelines for internal format

- c. May require adherence to specific guidelines for certain types of articles—e.g., CONSORT for randomized trials
- 3. Look over recent articles published there
 - a. Suggests normal range for length, level of detail
 - b. May offer good examples on internal organization of Methods section
- D. Review *Uniform Requirements for Manuscripts Submitted to Biomedical Journals* (www.icmje.org)
 - 1. Discusses generic issues of manuscript format
 - 2. Helps make manuscript portable to another journal if first choice doesn't take it
 - 3. Provides links to guidelines and checklists for certain types of articles

Guidelines	Apply to:
CONSORT	Randomized trials
STARD	Diagnostic test evaluations
QUOROM	Systematic reviews, meta-analyses
STROBE	Observational studies in epidemiology
MOOSE	Meta-analyses of observational studies in epidemiology

II. Writing

A. General advice [2, 3]

- 1. Don't re-invent the wheel on format: can usually follow a generic outline that applies to most medical journal articles (see Appendix), including subsection headings
 - a. Reminds you what should be included
 - b. Puts pieces into the order that readers expect
 - c. Breaks the overall job of writing into smaller, more manageable tasks
- 2. Keep your audience in mind
 - a. Thesis committee members*
 - b. Journal reviewers*
 - c. Other researchers on the topic*
 - d. Rank and file journal readers

*Will be keenly attentive to details. Don't "dumb down" your work to make it accessible to a clinician without research training; readers who cannot understand or appreciate the importance of methodological features will skip over them anyway.

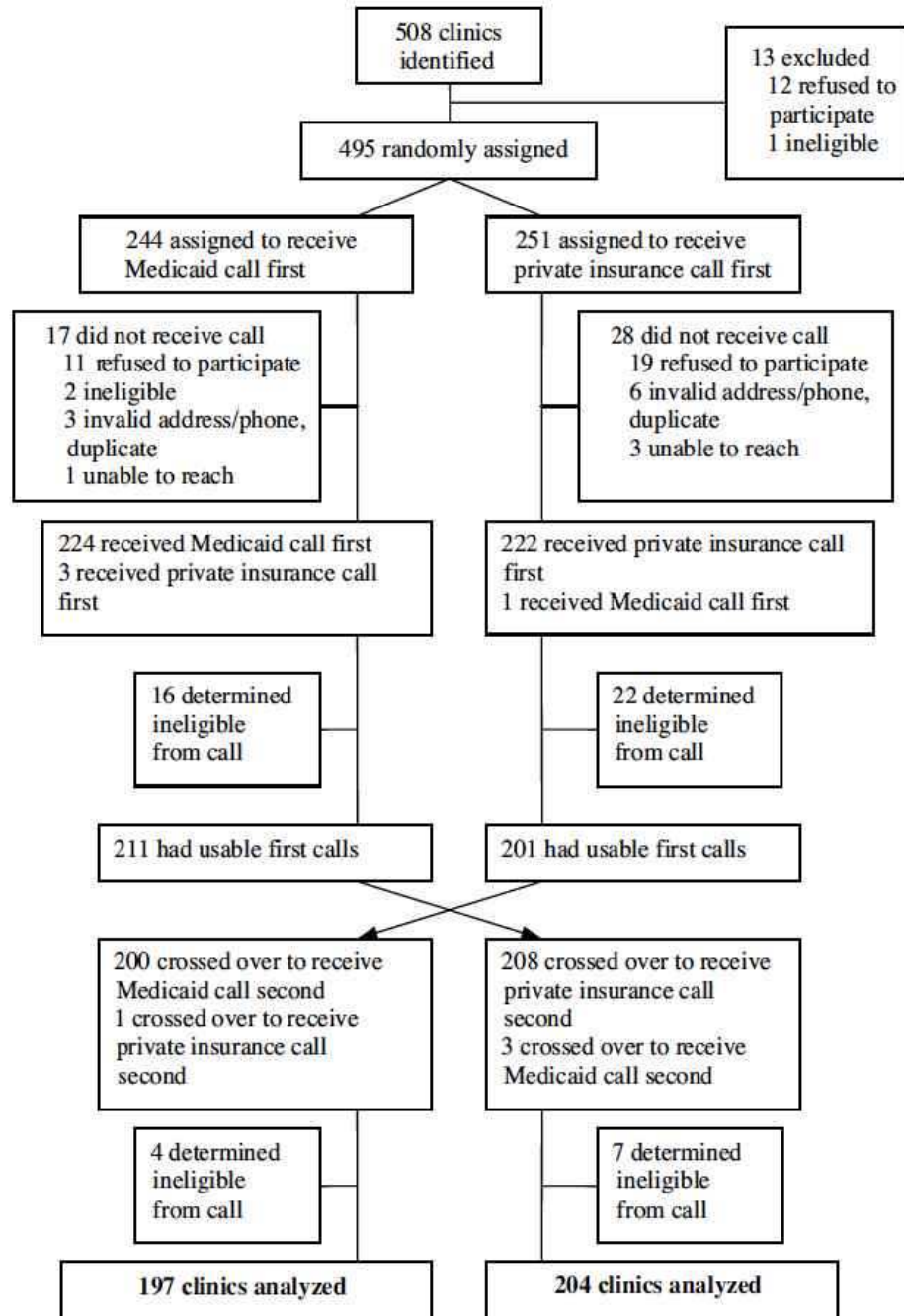
- 3. Try to give enough information to allow a knowledgeable researcher to replicate the study
- 4. When rationale for some aspect of methods may not be obvious, or a compromise had to be made, don't just describe what was done; *explain why*.

5. Introduction and Methods can often be drafted before results are available, drawing heavily on thesis proposal
 6. Wise to have a final or near-final set of tables and figures in hand before starting to write the Results and Discussion sections
- B. Suggestions on subsections of Methods section
1. Study design
 - a. May be just one sentence if study followed a standard design—e.g., randomized trial, case-control study, case series
 - b. Not all studies are straightforward examples of a standard study design. If yours is not, consider falling back to a more generic design category (e.g., “observational study”) in which it clearly fits and briefly describe what was done—formation of comparison groups, basic observation sequence—without trying to assign an ill-fitting design label.
 - c. Example from a study of whether timeliness of clinic appointments for newborn follow-up depended on the insurance status of a simulated “client” [4]:

“We used a randomized crossover study design to assess the effect of insurance status on appointment timeliness within clinics. We used a cross-sectional analysis to assess appointment timeliness between clinics that did and did not accept Medicaid.”
 2. Setting
 - a. Provides a context for the research, which affects scope of generalizability
 - b. May mention special opportunities or constraints that affected conduct of the research
 - c. Example from a study of effects of emergency-visit copayment on promptness of care-seeking in patients with chest pain [5]:

“The study was conducted at Group Health Cooperative of Puget Sound, a prepaid health plan in western Washington State with more than 500,000 enrollees who receive medical care from salaried providers. Most subscribers are insured under contracts with employers or government agencies that specify the amount of their copayment. For over 90 percent of enrollees, the emergency department copayment is not a matter of subscribers’ choice.”
 3. Study subjects
 - a. Source(s) and sampling method—affect representativeness and generalizability of the results
 - b. Eligibility criteria
 - c. Formation of final analytic sample—sometimes best described with a flow diagram, a la CONSORT. (Some journals ask that this material be the initial topic in Results rather than part of Methods.)

- d. Example of flow diagram from study noted above about timeliness of clinic appointments for newborns [4]:



4. Intervention, if any
- Describes what was done in ways that let readers judge its potency, resource requirements, amenability to implementation elsewhere
 - Example from a study of whether a clinic-based intervention in pediatricians' offices could increase enrollment in Head Start [6]:

“... Families of all children in the control and intervention groups

were given a language-appropriate telephone contact list of all Head Start agencies in the metropolitan Seattle area. For intervention children, a referral packet was also generated by computer and mailed directly to Head Start by study personnel; the packet contained a physician referral letter, including information for Head Start to contact the family; a physical examination form; and the child's immunization record. The second and third items were included only if available. Every Head Start agency in the target area participated in the project. None altered its established enrollment criteria to prioritize children from the study, and all signed a memorandum of understanding prior to study participation."

5. Data sources (or data collection)
 - a. Mention only data actually used in present paper
 - b. Method(s) of measurement
 - c. If a previously used instrument or scale, references to source and information about validity or reliability
 - d. Steps taken within the study to check and promote data quality
 - e. Example from a case-control study of whether screening for diabetes is effective at preventing end-organ complications [7]:

"Reviewers were not blinded to whether individuals were case subjects or control subjects. After eligibility as a study subject was verified, chart reviewers recorded every blood glucose test performed during the 10-year review period (the 10 years before the reference date). For each test, the following information was recorded: date, type of test (fasting or random, oral glucose tolerance test, hemoglobin A1c), result, whether any abnormal result had clinical follow-up, and the clinical intent or indication for the test. This last item was judged by examination of clinicians' notes and was categorized using the following guidelines:

"1. Tests for symptoms referable to diabetes. These tests occurred in the setting of classic symptoms of diabetes (e.g. polyuria, polydipsia, or polyphagia) or in the course of investigations of diseases or symptoms where diabetes might be have been a cause or underlying factor (Table 2).

"2. Tests without symptoms of diabetes. There were two subtypes of these tests. The first subtype comprised so-called 'population screening' tests, where the clinical intent was deliberately to screen for diabetes per se. The second subtype comprised so-called 'opportunistic screening' or 'case-finding' tests, where the measurement of glucose was incidental to other clinical investigations (e.g. evaluations of acute gastrointestinal illness or follow-up of chronic diseases such as hypertension) and was not driven by concerns about diabetes.

"3. Unknown. If after medical record review the clinical intent of the test could not be categorized using the rules enumerated in (1) and (2) or was otherwise ambiguous, this classification was used.

“Data were gathered from the medical record on each subject about factors that were possible confounders. These included possible risk factors for diabetic microvascular complications that might also be associated with increased screening activity, such as body mass index (BMI) at or near to the reference date, family history of diabetes (as indicated in the medical record), and number of preventive or health maintenance visits over the review period. The presence or absence in the medical record of three comorbid states (hypertension, coronary artery disease, and hyperlipidemia) during the review period was also recorded. These conditions might also be related to the likelihood of being screened, and, at least in the case of hypertension, may be related to the likelihood of having a microvascular complication.”

6. Analysis

- a. Identification of key variables and their analytic roles
- b. How key variables were defined and operationalized: e.g., categories used for analysis
- c. Statistical techniques used to obtain reported estimates, p-values, confidence limits
- d. Example from a study of physician experience with treating AIDS patients and survivorship with AIDS [8]:

“To control for improved survival due to advances in the treatment of AIDS, we grouped the dates on which patients were given diagnoses of AIDS-defining illnesses into three calendar-year periods. The first period, 1984 to 1986, preceded the availability of zidovudine and chemoprophylaxis against *Pneumocystis carinii* pneumonia, which became period, 1989 to 1994, both drug regimens were in general use and zidovudine was recommended for patients with CD4 cell counts below 500 per cubic millimeter. Previous cohort studies of HIV-infected homosexual and bisexual men have found increases in survival from the earliest to the latest of these periods.

“Severity of illness at entry into the study was determined according to a three-stage classification of AIDS-defining diagnoses developed by Turner and colleagues. Conditions such as Kaposi sarcoma are included in the category of least severe illness, moderately severe illness is defined as *P. carinii* pneumonia, and the category of most severe illness includes diagnoses such as disseminated infection with *Mycobacterium avium* complex. CD4 cell counts at the time of the diagnosis of AIDS were available for 244 of the 278 patients in whom first AIDS-defining illnesses were diagnosed from 1989 to 1994 (88 percent) and were classified into four levels: 0 to 49, 50 to 99, 100 to 199, and 200 or more per cubic millimeter.

“We estimated median survival and survival curves from the time of the diagnosis of AIDS according to the patients age, the calendar period of the diagnosis, the severity of illness, the CD4 cell count at diagnosis,

and physician-experience category, using KaplanMeier survival analysis. Statistical significance was evaluated with the logrank test. Unadjusted and adjusted relative risks of death according to physician-experience category, the calendar period of the diagnosis, the severity of illness, and the CD4 cell count at diagnosis were estimated with Cox proportional-hazards analysis. Statistical significance for the relative risks was evaluated with the likelihood-ratio test. The test for trend in proportions was used to examine the relation between a physicians use of prophylaxis against *P. carinii* pneumonia, measurement of CD4 cells, and use of antiretroviral therapy and that physicians level of experience with AIDS. The association between the use of prophylaxis against *P. carinii* pneumonia and the occurrence of *P. carinii* pneumonia as a patients AIDS-defining illness was evaluated with the chi-square test. We used generalized estimating equations to evaluate the robustness of the results with respect to the assumption of statistical independence among patients. We also examined physician-experience category as a time-dependent covariate to take into account the experience gained during the care of an individual patient with AIDS. Two-tailed P values of 0.05 or less were considered to indicate significance in all statistical tests.”

III. Getting feedback and making revisions

A. Make thesis drafts reviewer-friendly

1. Double-space (to allow room for mark-ups)
2. Use 12-point or larger font
3. Use at least 1-inch margins
4. Number the pages
 - a. Page numbers will surely change during revision process, but that doesn't matter
 - b. Provides an easy way for readers to identify the text referred to in a comment
5. Proof it yourself to correct obvious errors

B. Allow a reasonable amount of time for readers to review

C. Wait for comments on one draft before preparing another

D. If possible, discuss comments on drafts in person with thesis committee members, individually or in a group

1. Meeting date sets a deadline for completion of review
2. Better learning experience when reviewer can elaborate on the rationale behind comments
3. May provide chance to resolve conflicting advice

IV. Publishing

A. Guidelines on authorship from the International Committee of Medical Journal Editors:

“Authorship credit should be based on 1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; 2) drafting the article or revising it critically for important intellectual content; and 3) final approval of the version to be published. Authors should meet conditions 1, 2, and 3.”

B. Dealing with results of journal review

1. If accepted: celebrate! (safely, of course)
2. If invited to revise and resubmit
 - a. Treat as a “foot in the door” and revise for that journal
 - b. Include a possibly lengthy cover letter with the revision, containing a point-by-point response to reviewers’ comments
 - i. Unless following a reviewer suggestion would actually do damage, try to honor it
 - ii. If a reviewer’s suggestion was based on misinterpretation, try to improve and clarify wording anyway to prevent this happening to other readers
 - iii. If following a reviewer’s advice would do damage, use cover letter to provide a careful explanation of why
3. If rejected
 - a. Don’t take it personally—you’re in good company
 - b. Scavenge for useful suggestions in any reviewers’ comments provided by journal
 - c. Try to submit promptly to another journal (which you might have in mind already)
 - d. Persistence pays

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Appendix: Generic Thesis Outline
(Not all headings relevant to all theses)

I. Introduction

- A. Why is the problem important?
- B. What important knowledge gaps remain despite previous work?
- C. What specific research question(s) did your project address?

II. Methods

- A. Study design
- B. Setting
- C. Study subjects
 - 1. Source of subjects
 - 2. Sampling method
 - 3. Criteria for eligibility
 - 4. Number, response rates
- D. (Description of intervention, if any)
- E. Data collection (or data sources)
 - 1. Sources: questionnaire, interview, medical record review, vital records, etc.
 - 2. Protocol for a typical subject
 - 3. Steps taken to assess and assure data quality
- F. Analysis
 - 1. Definition of key analytic variables, if not obvious
 - 2. Statistical methods used
 - 3. Statistical basis for sample size, if appropriate

III. Results

- A. Description of study sample
- B. Table(s) or figure(s) addressing each research question
- C. Text used to highlight (not to repeat verbatim) results shown in tables and figures

IV. Discussion

- A. Brief recap of key result(s)
- B. Study strengths and limitations
- C. How key results compare or contrast with previous work
- D. Implications
 - 1. For theory
 - 2. For public health practice or clinical practice
 - 3. For future research