

PubH 8482
Sequential and Adaptive Methods for Clinical Trials
Fall 2017

Credits: 3
Meeting Days: Monday and Wednesday
Meeting Time: 9:45a – 11:00a
Meeting Place: Moos 1-430
Instructor: Thomas Murray
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Office Hours: Monday 1:00p – 2:00p, Thursday 11:00a – 12:00p

I. Course Description

When done effectively, randomized controlled clinical trials are the gold standard for assessing the effect of an intervention in human subjects. Clinical trials are expensive, time-consuming and expose subjects to potentially harmful and ineffective treatments. Sequential and adaptive designs, as opposed to fixed-sample designs, can be more efficient and expose fewer subjects to harmful and ineffective treatments. These designs present many statistical challenges, however, such as controlling type I error. In this course, we will discuss sequential and adaptive designs for clinical trials; the statistical properties and challenges these designs engender; and their pros and cons relative to a fixed-sample design.

Acknowledgments

The contents of PubH 8482 have been developed with contributions of Dr. Koopmeiners, who is a previous instructor of this course.

II. Course Prerequisites

Stat 8101-8102 or equivalent; students should be comfortable with the multivariate normal distribution.

III. Course Goals and Objectives

- Students will be exposed to adaptive methods in clinical trials
- Students will understand the challenges of applying sequential and adaptive methods to clinical trials
- Students will understand the advantages and disadvantages of sequential and adaptive clinical trial designs

- Students will be familiar with standard group sequential methodology

IV. Methods of Instruction and Work Expectations

Students are expected to attend class, participate in class discussions and complete homework assignments, the midterm exam and final project. **Working together on homework assignments is permitted but each student is expected to write-up solutions in their own words based on their own computing. The take-home midterm exam should be completed independently, however.**

The course will use a website on Moodle at: <https://ay17.moodle.umn.edu/course/view.php?id=5263>

This site can also be accessed by going to:

- myu.umn.edu → Academics tab (official instructor and students only)
- ay17.moodle.umn.edu → Course Overview
- moodle.umn.edu → Course Overview (during the 2017 and 2018 academic years)

Further instructions for locating the course page is provided at: <https://it.umn.edu/moodle-students-find-your-moodle-course>

In this class, our use of technology will sometimes make students' names and U of M Internet IDs visible within the course website, but only to other students in the same class. Since we are using a secure, password-protected course website, this will not increase the risk of identity theft or spamming for anyone in the class. If you have concerns about the visibility of your Internet ID, please contact me for further information.

V. Course Text and Readings

Although there is no required text, the lecture notes will draw from the following texts:

Jennison, C. and Turnbull, B. (1999) Group Sequential Methods with Applications to Clinical Trials, Boca Raton, FL: CRC Press. ISBN 0849303168 (Biostat Reading Room)

Proschan, M.A., Lan, K.K.G. and Wittes, J.T. (2006) Statistical Monitoring of Clinical Trials: A Unified Approach, New York, NY: Springer. ISBN 0387300597 (Biostat Reading Room)

Berry, S.M., Carlin, B.P., Lee, J.J. and Muller, P. (2010) Bayesian Adaptive Methods for Clinical Trials, Boca Raton, FL: CRC Press. ISBN 1439825483 (Biostat Reading Room)

Other useful texts include:

Whitehead, J. (1997) The Design and Analysis of Sequential Clinical Trials, 2nd Ed., New York, NY: John Wiley & Sons. ISBN 0471975508 (Physical copy via U-MN Libraries)

Yin, G. (2012) Clinical Trial Design: Bayesian and Frequentist Adaptive Methods, Hoboken, NJ: John Wiley & Sons. ISBN 0470581719 (Online access via U-MN Libraries)

Chow, S. and Chang, M. (2012) Adaptive Design Methods in Clinical Trials, 2nd Ed., Boca Raton, FL: CRC Press. ISBN 1439839883 (Online access via U-MN libraries)

Bartroff, J., Lai, T. and Shih, M. (2013) Sequential Experimentation in Clinical Trials: Design and Analysis, New York, NY: Springer. ISBN 1461461146 (Online access via U-MN Libraries)

Yuan, Y., Nguyen, H.Q. and Thall, P.F. (2016) Bayesian Designs for Phase I–II Clinical Trials, Boca Raton, FL: CRC Press. ISBN 1498709552 (Purchase)

Shih, W.J. and Aisner J. (2016) Statistical Design and Analysis of Clinical Trials, Boca Raton, FL: CRC Press. ISBN 1482250510 (Purchase)

VI. Course Outline/Weekly Schedule

Tentative Schedule:

- Week 1: Course Introduction
- Week 2: Overview of the Multivariate Normal distribution as it relates to sequential testing
- Weeks 3 and 4: Sequential testing of Normal Random Variables
- Week 5: Error Spending Functions

- Week 6: Brownian Motion and Asymptotically Normal test statistics
- Week 7: Point Estimation after a Group Sequential Test
- Week 8: Interval Estimation after a Group Sequential Test
- Weeks 9 and 10: Adaptive methods for Phase 1 clinical trials
- Weeks 11 – 14: Topics in adaptive clinical trials
- Week 15: Student Presentations

VII. Evaluation and Grading

There will be approximately 4 homework assignments. Students will have two weeks to complete each assignment. There will be a take-home midterm exam towards the middle of the semester with the specific date to be determined. In addition, each student will complete a final project that will consist of a paper and a 25 minute presentation. For the final project, students are expected to complete a literature review of a sub-area of sequential and adaptive designs, providing a summary of current and past research and identifying open research questions in the area.

A student's final grade will be calculated by weighting the three components of the course (homework, mid-term and final project) as follows:

- Homework – 40%
- Mid-term – 30%
- Final project – 30%

A letter grade will be determined from the percentage of points each student receives as follows:

- A 93 - 100%
- A- 90 – 92%
- B+ 87 – 89%
- B 83 – 86%
- B- 80 – 82%
- C+ 77 – 79%
- C 73 – 76%
- C- 70 – 72%
- D+ 67 – 69%
- D 63 – 66%
- F 0 – 62%

The University utilizes plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following:

- A 4.000 - Represents achievement that is outstanding relative to the level necessary to meet course requirements
- A- 3.667
- B+ 3.333
- B 3.000 - Represents achievement that is significantly above the level necessary to meet course requirements
- B- 2.667

C+	2.333
C	2.000 - Represents achievement that meets the course requirements in every respect
C-	1.667
D+	1.333
D	1.000 - Represents achievement that is worthy of credit even though it fails to meet fully the course requirements
S	Represents achievement that is satisfactory, which is equivalent to a C- or better.

For additional information, please refer to:

<http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html>.

Course Evaluation

The SPH will collect student course evaluations electronically using a software system called CourseEval: www.sph.umn.edu/courseval. The system will send email notifications to students when they can access and complete their course evaluations. Students who complete their course evaluations promptly will be able to access their final grades just as soon as the faculty member renders the grade in SPHGrades: www.sph.umn.edu/grades. All students will have access to their final grades through OneStop two weeks after the last day of the semester regardless of whether they completed their course evaluation or not. Student feedback on course content and faculty teaching skills are an important means for improving our work. Please take the time to complete a course evaluation for each of the courses for which you are registered.

Incomplete Contracts

A grade of incomplete “I” shall be assigned at the discretion of the instructor when, due to extraordinary circumstances (e.g., documented illness or hospitalization, death in family, etc.), the student was prevented from completing the work of the course on time. The assignment of an “I” requires that a contract be initiated and completed by the student before the last official day of class, and signed by both the student and instructor. If an incomplete is deemed appropriate by the instructor, the student in consultation with the instructor, will specify the time and manner in which the student will complete course requirements. Extension for completion of the work will not exceed one year (or earlier if designated by the student’s college). For more information and to initiate an incomplete contract, students should go to SPHGrades at: www.sph.umn.edu/grades.

University of Minnesota Uniform Grading and Transcript Policy

A link to the policy can be found at onestop.umn.edu.

VIII. Other Course Information and Policies

Grade Option Change (if applicable):

For full-semester courses, students may change their grade option, if applicable, through the second week of the semester. Grade option change deadlines for other terms (i.e. summer and half-semester courses) can be found at onestop.umn.edu.

Course Withdrawal:

Students should refer to the Refund and Drop/Add Deadlines for the particular term at onestop.umn.edu for information and deadlines for withdrawing from a course. As a courtesy, students should notify their instructor and, if applicable, advisor of their intent to withdraw.

Students wishing to withdraw from a course after the noted final deadline for a particular term must contact the School of Public Health Office of Admissions and Student Resources at sph-ssc@umn.edu for further information.

Student Conduct Code:

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see:
http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf.

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Use of Personal Electronic Devices in the Classroom:

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference:
<http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>.

Scholastic Dishonesty:

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf) If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see:
<http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html>.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: <http://www1.umn.edu/oscai/integrity/student/index.html>. If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

Makeup Work for Legitimate Absences:

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see:
<http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html>.

Appropriate Student Use of Class Notes and Course Materials:

Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see: <http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>.

Sexual Harassment:

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with

an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy: <http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf>

Equity, Diversity, Equal Opportunity, and Affirmative Action:

The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy: http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations:

The University of Minnesota is committed to providing equitable access to learning opportunities for all students. The Disability Resource Center Student Services is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DRC at 612-626-1333 or drc@umn.edu to arrange a confidential discussion regarding equitable access and reasonable accommodations.

If you are registered with DS and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course.

For more information, please see the DS website, <https://diversity.umn.edu/disability/>.

Mental Health and Stress Management:

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: <http://www.mentalhealth.umn.edu>.

The Office of Student Affairs at the University of Minnesota:

The Office for Student Affairs provides services, programs, and facilities that advance student success, inspire students to make life-long positive contributions to society, promote an inclusive environment, and enrich the University of Minnesota community.

Units within the Office for Student Affairs include, the Aurora Center for Advocacy & Education, Boynton Health Service, Central Career Initiatives (CCE, CDes, CFANS), Leadership Education and Development – Undergraduate Programs (LEAD-UP), the Office for Fraternity and Sorority Life, the Office for Student Conduct and Academic Integrity, the Office for Student Engagement, the Parent Program, Recreational Sports, Student and Community Relations, the Student Conflict Resolution Center, the Student Parent HELP Center, Student Unions & Activities, University Counseling & Consulting Services, and University Student Legal Service.

For more information, please see the Office of Student Affairs at <http://www.osa.umn.edu/index.html>.

Academic Freedom and Responsibility: *for courses that do not involve students in research:*

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*

OR:

Academic Freedom and Responsibility, for courses that involve students in research

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom and conduct relevant research. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.* When conducting research, pertinent institutional approvals must be obtained and the research must be consistent with University policies.

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, (Dr Kristin Anderson, SPH Dean of Student Affairs), or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

** Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".*

Student Academic Success Services (SASS): <http://www.sass.umn.edu>:

Students who wish to improve their academic performance may find assistance from Student Academic Support Services. While tutoring and advising are not offered, SASS provides resources such as individual consultations, workshops, and self-help materials.