

# Introduction to Biostatistics

University of Iowa  
BIOS:4120 / BIOS:5110  
Spring 2015  
Credit: 3 s.h.

|                     |  |                      |   |
|---------------------|--|----------------------|---|
| <b>Lecture:</b>     | 9:30 a.m - 10:50 a.m.<br>Tuesday & Thursday<br>CPHB N110 | <b>Instructor:</b>   | Prof. Patrick Breheny   |
|                     |  | <b>Office:</b>       | N336 CPHB   |
|                     |  | <b>Phone:</b>        | 384-1584  |
|                     |  | <b>e-mail:</b>       | patrick-breheny@uiowa.edu   |
|                     |  | <b>Office hours:</b> | Mon. 9:00 a.m. – 11:00 a.m.<br>Wed. 1:00 p.m. – 3:00 p.m.                                 |
| <b>Section A01:</b> | 11:00 a.m – 11:50 a.m.<br>Tuesday<br>CPHB C201           | <b>TA:</b>           | Ryan Peterson   |
|                     |  | <b>e-mail:</b>       | ryan-peterson@uiowa.edu   |
|                     |  | <b>Office hours:</b> | Mon. 2:30 p.m. – 4:00 p.m.<br>Wed. 8:30 a.m. – 10:00 a.m.<br>Thu. 2:30 p.m. – 3:30 p.m.   |
| <b>Section A02:</b> | 11:00 a.m – 11:50 a.m.<br>Tuesday<br>CPHB C401           | <b>TA:</b>           | Joseph Moen   |
|                     |  | <b>e-mail:</b>       | joseph-moen@uiowa.edu   |
|                     |  | <b>Office hours:</b> | Mon. 12:00 p.m. – 1:00 p.m.<br>Tue. 12:30 p.m. – 2:30 p.m.<br>Wed. 12:00 p.m. – 1:00 p.m. |
| <b>Section A03:</b> | 3:00 p.m - 3:50 p.m.<br>Wednesday<br>CPHB C401           | <b>TA:</b>           | Joseph Moen   |
|                     |  | <b>e-mail:</b>       | joseph-moen@uiowa.edu   |
|                     |  | <b>Office hours:</b> | See Section A02   |
| <b>Section A04:</b> | 3:00 p.m - 3:50 p.m.<br>Wednesday<br>CPHB C310           | <b>TA:</b>           | Ryan Peterson   |
|                     |  | <b>e-mail:</b>       | ryan-peterson@uiowa.edu   |
|                     |  | <b>Office hours:</b> | See Section A01   |

All TA Office hours will be held in CPHB S249. If you are unable to make it to office hours, feel free to contact one of us to set up an appointment.

**Course description:** This is an introductory course that covers the primary statistics concepts and methods used in medicine, public health, and the biological sciences. The objectives for this course are for you to be able to:

- Think statistically – to understand the importance of collecting data and using appropriate statistical methods in order to test hypotheses, estimate unknown quantities, and conduct research
- Analyze data using basic statistical methods
- Recognize the strengths and limitations of those methods

- Better comprehend journal articles containing statistical analyses
- Have the necessary background to enroll in Design & Analysis of Biomedical Studies (BIOS 5120)

**Suggested text:** No text is required in this course; the notes are self-sufficient. Many students, however, like to purchase a textbook for (a) additional problems/exercises/examples or (b) another perspective or explanation of a topic. I suggest the following two texts:

- Daniel, W. (2013): *Biostatistics: A Foundation for Analysis in the Health Sciences (Tenth Edition)*. Wiley.
- Motulsky, H. (2013): *Intuitive Biostatistics (Third Edition)*. Oxford University Press.

The book by Daniel provides hundreds of additional examples and problems. In my opinion, it is the best book for purpose (a) above. The book by Motulsky attempts to get across the ideas of statistics using verbal explanations and examples rather than equations, and is the best book I know of for purpose (b) above. The book does not, however, have problems, solutions, and exercises.

**Prerequisite:** College algebra.

**Course website:** The course notes, assignments, data sets, and other relevant materials will be made available on the course web site:

<http://myweb.uiowa.edu/pbreheny/4120/s15>

Grades, solutions, copyrighted articles, and other things that cannot be posted to the web will be made available via ICON: <https://icon.uiowa.edu>

**Homework:** There will be one homework assignment per week, due the following week at the beginning of class on Tuesday. Graded assignments will be returned in lab. Solutions will be posted to ICON on Tuesday afternoons. Clearly, no homework can be accepted after that (see the section on grading for ramifications).

You are encouraged to work in groups of two or three, and turn in one copy of the homework per group. I have found this to work very well in the past, as group discussions are valuable for retention and understanding of the material, and working well in a group is a vital part of being a professional. If you would like help in finding a group, please send your TA an e-mail.

**Computing:** Homework for this course will occasionally involve the use of a computer for data analysis. You may use any statistical software you would like for this analysis, although the software that we will be cover in lecture is R. R is free, open-source software and runs on all operating systems (Windows/Mac/Linux).

**Quizzes:** There will be four quizzes in this class. Quizzes will replace the last half-hour of lecture on the following dates:

- Quiz 1 February 12
- Quiz 2 March 5
- Quiz 3 April 9
- Quiz 4 April 30

You will be asked to perform calculations on these quizzes, so bring a calculator with you.

**Final exam:** There will be a comprehensive final exam in this class; time and date to be determined.

**Grading:** Your grade will be based on a weighted average of homework (26%), quizzes (37%), and the final exam (37%). Each homework assignment is worth 2% of your grade. If you fail to turn in a homework assignment, that 2% of weight is added to the quizzes and final exam (each getting 1%). For example, suppose you only turn in 11 of the 13 homework assignments; in that case, homework would be worth 22% of your final grade, and quizzes and the final exam each worth 39%.

In the event that a grade on a homework assignment is lower than your quiz/final average, that homework will be automatically dropped – *i.e.*, turning in homework cannot hurt your final grade in this course.

**Attendance:** Regular attendance in this course is expected. No direct penalty will be applied for missing lectures. However, assignments, quizzes, and the final will be based entirely on lecture material, so skipping lecture is likely to hurt your grade (and, of course, your understanding of the material).

**Corrections:** Despite my best efforts, my notes occasionally have mistakes. If you spot a mistake, I very much want you to let me know about it so that I can correct it. I will award 1 bonus point (to be added to your homework total) for pointing out a typographical error and three bonus points for an error in content. Corrections will be made to the online version of the notes and described on the course home page. Once an error has been corrected online, no more bonus points for that mistake are available.

**Electronic communication:** I will occasionally send notices to the class through e-mail (to your [uiowa.edu](mailto:uiowa.edu) account), so please check that account regularly.

**Academic misconduct:** You are allowed (encouraged!) to work together on homework assignments. In addition, quizzes and the final exam are open-book, open-note. However, you are not allowed to copy off another student during exams, or use a cell phone or any device capable of messaging, texting, or accessing the internet. Any of these actions will be considered cheating. The University of Iowa takes cheating on examinations very seriously, and has in place a number of rather severe academic sanctions, a guide to which may be found at <http://dos.uiowa.edu/policy-list/current/student-responsibilities-6/academic-misconduct-6>.

**Complaints:** Students with suggestions or complaints should see me first, and if we cannot come to an agreement, I will direct you to the head of the department, Prof. Joseph Cavanaugh, [joe-cavanaugh@uiowa.edu](mailto:joe-cavanaugh@uiowa.edu). Students may also contact the Associate Dean for Education and Student Affairs in the College of Public Health or the Office of the University Ombudsperson. If a complaint cannot be resolved at the departmental and/or collegiate level, students may file a formal complaint utilizing the procedure specified in the Operations Manual (II-29.7)

**Disabilities:** If anyone has a disability requiring special accommodations, please let me know as soon as possible, so that these arrangements can be made.

**Administrative Home:** This course is given by the College of Public Health. This means that class policies on matters such as requirements, grading, and sanctions for academic dishonesty are governed by the College of Public Health. Students wishing to add or drop this course after the official deadline must receive the approval of the Associate Dean for Academic and Student Affairs in the College of Public Health. Details of the University policy of cross enrollments may be found at: <http://www.uiowa.edu/~provost/deos/crossenroll.doc>.

**Sexual Harassment:** Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Operations Manual for the full University Policy: <http://www.uiowa.edu/~our/opmanual/ii/04.htm>.

**Severe Weather:** In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit <http://hawkalert.uiowa.edu>.

**Public Health Competencies:** Successful students in this course will learn to do the following:

1. Describe the role of biostatistics in the Public Health discipline
2. Describe basic concepts of probability, random variation and commonly used statistical probability distributions.
3. Describe preferred methodological alternatives to commonly used statistical methods when assumptions are not met.
4. Distinguish among the different measurement scales and the implications for selection of statistical methods to be used based on these distinctions.
5. Apply descriptive techniques commonly used to summarize public health data.
6. Apply common statistical methods for inference.
7. Apply descriptive and inferential methodologies according to the type of study design for answering a particular research question.
8. Apply basic informatics techniques with vital statistics and public health records in the description of public health characteristics and in public health research and evaluation.
9. Interpret results of statistical analyses found in public health studies.

**Course schedule (Subject to change):**

| Week of            | Topics  |
|--------------------|---|
| January 22         | Introduction; study design  |
| January 29         | Hypothesis tests and confidence intervals   |
| February 5         | Observational studies and confounding<br>Descriptive statistics and graphics                |
| <b>February 12</b> | Correlation and regression  |
| February 19        | Probability   |
| February 26        | The binomial distribution<br>One-sample categorical data                                    |
| <b>March 5</b>     | The normal distribution   |
| March 12           | The central limit theorem   |
| March 19           | Spring break – no class   |
| March 26           | Applying the central limit theorem<br>Approximate inference for one-sample categorical data |
| April 2            | One-sample continuous data<br>Power and sample size   |
| <b>April 9</b>     | Two-sample categorical data (start)   |
| April 16           | Two-sample categorical data (end)<br>Two-sample continuous data (start)                     |
| April 23           | Two-sample continuous data (end)  |
| <b>April 30</b>    | Multiple comparisons and ANOVA  |
| May 7              | Survival analysis   |
| <b>May 14</b>      | Final exam  |

Bold denotes the dates of quizzes and tests – note that the date for the final exam has not yet been set by the University.

I look forward to getting to know you, and I hope that we have a great semester together.