# RUTGERS
School of Public Health

**Course Title:** Applied Categorical Data Analysis

**Course Number:** BIST 0615

**Course Pre- and Co-requisite(s):** PHCO0504 / BIST 0512 <u>and</u> BIST0551 / BIST 0610 <u>and</u> BIST 0535

**Course Location:** Piscataway, SPH Room 3A/3B

**Course Date & Time:** Wednesday 6:00-8:00pm

**Course Instructor:** Pamela Ohman Strickland, PhD, Associate Professor, Room 220

**Course Assistant:** Chang Xu, Biostatistics PhD Student

**Contact Information:** ONLY use the CANVAS email system to correspond with the professor and Course Assistant concerning course issues. I <u>will not</u> respond to class emails sent to my regular Rutgers email account. (For other purposes, e.g., if I am your advisor or mentor you in research, use pam.strickland@rutgers.edu.)

**Office Hours:** <u>With Professor</u>: By appointment.

<u>With Course Assistant</u>: 3-5 on Wednesdays before class, Room 206.

**Course Website:** *canvas.rutgers.edu* Please contact professor and Course Assistant via CANVAS email.

**Required Course Text:** Agresti, A. (2007) *An Introduction to Categorical Data Analysis, 2nd edition.* John Wiley & Sons. ISBN-13: 978-0-471-22618-5.

The textbook above covers most of the class material. Some lectures will be more in depth, covering material not in the textbook. Agresti's big "Categorical Data Analysis" book (ISBN-13: 978-0470463635) is the standard for statistics PhD (and some mathematically minded) students but can be a bit difficult to read at several points. I would encourage to get one or the other of these books, although the Introduction textbook is the official textbook for the class.

**Supplemental Resource:** Stokes, M.E., Davis, C.S. and Koch, G.G. *Categorical Data Analysis Using the SAS System, 2nd Edition.* SAS Publishing

**Course Description:** Public health studies, especially those involving questionnaires, contain large amounts of categorical data. This class introduces descriptive and inferential statistics for univariate and multivariate categorical data with applications to epidemiological and clinical studies. For 2 and 3-way contingency tables, measures of association and tests for homogeneity between populations and independence of variables are presented. Related tests of trend for ordinal data are studied. Loglinear and logistic regression analyses are investigated for data sets with both nominal and ordinal variables.

Computing Language: SAS

**Selected Concentration Competencies Addressed:** Each Concentration identifies competencies for each degree offered. The competencies addressed in this course for the MPH in Biostatistics include:

1. Integrate relevant scientific background to design experimental and observational studies in biomedical, clinical and public health research;
2. Use statistical computer packages to organize, analyze and report collected data;
3. Apply basic probability theory and standard statistical methods to biomedical, clinical and public health research;
4. Review and critique statistical methods and interpretations presented in published research studies, presentations or reports; and
5. Communicate the results of statistical studies both in writing and orally to investigators and lay community members.

Competencies for the MS Program include:
6. Apply probability and statistical methods to design experimental and observational studies in biomedical, clinical, and public health research
7. Use probability and statistical theory to evaluate and identify appropriate methods of analysis
8. Conduct appropriate statistical analysis of data to solve medical and public health problems
9. Use a variety of statistical computer packages
10. Communicate the results of statistical studies both in writing and orally to investigators and lay community members

Please visit the Concentration webpages on the School of Public Health's website at sph.rutgers.edu for additional competencies addressed by this course for other degrees and concentrations.

**Course Objectives:** By the completion of this course, students will be able to:

a. Formulate appropriate statistical hypotheses for examining cross-classified data from public health and clinical studies
b. Justify the basic theoretical models for categorical data
c. Create and/or actively participate in the design and analysis plan for a study involving categorical data, whether nominal or ordinal in nature
d. Conduct and/or actively participate in the analysis of categorical data
e. Interpret results from contingency tables or generalized linear models that evaluate relationships between categorical variables
f. *Communicate results with non-statisticians, both verbally and in writing*

**Writing & Communication**

This class includes a heavy emphasis on interpreting and communicating results, verbally and in writing, to scientists and lay-people.

**Course Requirements and Grading:**

Your grade will be determined according to the following assignments:

1. Assessments *                                              10%
2. Class Survey                                                   1%
3. Honor Code             1%
4. Written Results from SAS Output       1%
5. Discussion Boards (x4) **         13%
6. Project Plan (**graded**, no late submissions)     3%
7. Project Methods & Measures Write-up     1%
8. Project         15%
9. Midterm         25%
10. Final         30%

* Two lowest grades on weekly assessments will be dropped, with 3 attempts per assessment.
**All Initial posts for Discussion Boards are due on Monday before due date; any responses are due by start of Wednesday class

**Grading scale:**

| | |
|---|---|
| 94 – 100 | A |
| 90 – <94 | A- |
| 87 – <90 | B+ |
| 84 – <87 | B |
| 80 – <84 | B- |
| 77 – <80 | C+ |
| 70 – <77 | C |
| <70 | F |

Note: I may scale grades up (e.g., from 89.2 to an A-, although not guaranteed), but I never scale down (if you get a 90.0, you will not be scaled down to a B+). If everyone in the class earns an A, I am more than happy to give everyone an A!

Course Objectives, competencies, objectives, modules, and assessments are related as follows:

| Competency | Course Objectives(s) | Lessons | Assessment(s) |
|---|---|---|---|
| 1, 8 | a, c, f | 1, 3, 6 | Write-ups, Project |
| 2, 9 | c, d | 1-6, 8-14 | Discussion Boards, Project |
| 3, 6, 7 | a, b, c | 3, 4, 8 | Assessments, Midterm, Final, Journal Articles, Write-ups |
| 4 | b, e | 1-6, 8-14 | Assessments, Journal Articles |
| 5, 10 | a, e, f | 3, 4, 8 | Project, Write-ups |

**Course Schedule:** Subject to Change based on the needs of the class. <u>All assignments due by 6pm of next class.</u>

| Module | Date | Topic | Readings/ Multimedia | Online 30 | Weekly Assessments | Pts |
|---|---|---|---|---|---|---|
| **1** | Sept 7 | Introduction, Distributions & Sampling | • Read handout on one vs. two sided tests<br>• Review MLE of Binomial<br>• Agresti, Ch.1 | • Self-guided tour of basics, including review lecture | • Assessment: Module 1 + Review Material<br>• Fill out class survey<br>• Honor Code<br>• *Gain access to SAS & experiment with NHIS data (Help Session available) | 3 |
| | TBD | Help Session: SAS Access to NHIS Data | | | | |
| **2** | Sept 14 | Chi-square Tests – general & Pearson | • Journal Article #1, paying attention to structure of paper<br>• Agresti, 2.1,4,6 | • Recorded Lecture | • Assessment: Module 2 + Article #1<br>• *Review Documentation for NHIS data; identify variables of interest & research question (Help Session available) | 1 |
| | TBD | Help Session: Discussion of Research Questions | | | | |
| **3** | Sept 21 | Two-way Contingency Tables | • Agresti, 2.2,3 | • Recorded Lecture | • Assessment: Module 3<br>• Project Plan (using provided form, **graded**)<br>• DB: Research Question & Summaries of Outcome and predictor of interest | 7 |
| **4** | Sept 28 | Two-way Contingency Tables for Ordinal Data | • Agresti 2.5 | • Recorded Lecture | • Assessment: Module 4<br>• Written Study Methods & Measures for Project (submit on-line & bring 3 printed copies to next class) | 2 |
| **5** | Oct 5 | Analysis for Matched Pairs – binary outcomes | • Agresti 8.1 | • Recorded Lecture | • Assessment: Module 5<br>• DB: Association between two ordinal variables (one created from a continuous | 5 |

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|---|---|---|---|---|---|---|
| | | Discussion of Student Methods & Measures | | | variable), first using Pearson chi-square & then an appropriate test for ordinal association (class data) – compare results<br>• *Work on Project Tables 1 & 2 | |
| **6** | Oct 12 | Three-way tables | • Agresti 2.7 | • Handout | • Assessment: Module 6<br>• *Study<br>• *Get Started on:<br> ○ Sample Results from SAS Output | 1 (25) |
| **7** | Oct 19 | MIDTERM | | | • Written Results from SAS Output (submit on-line & bring 3 printed copies next class) | 1 |
| **8** | Oct 26 | Generalized Linear Models<br><br>Discussion: Written Results from SAS Output | • Agresti, Ch. 4 | • Recorded Lecture | • Assessment: Module 8<br>• *Work on Project Tables 1 & 2 and results summary | 1 |
| **9** | Nov 2 | Logistic Regression | • Journal Article #2, paying particular attention to structure of tables and description of results<br>• Agresti, 5.2 | • Recorded Lecture | • Assessment: Module 9 + Article #2<br>• DB: Logistic regression with an interaction, using class data (no responses required this time) | 4 |
| **10** | Nov 9 | Multi-category Logit Models | • Agresti, Ch. 6, especially 6.2 | • Recorded Lecture | • Assessment Module 10 | 1 |

| 11 | Nov 16 | Loglinear Modeling for Contingency Tables | • Agresti, Ch. 7 | • Recorded Lecture | • Assessment: Module 11<br>• DB: Proportional odds modeling – calculate and interpret Odds Ratios | 4 |
|---|---|---|---|---|---|---|
|  | Nov 23 | THANKSGIVING BREAK |  |  |  |  |
| 12 | Nov 30 | Model Building | • Agresti, 6.1 | • Recorded Lecture | • Assessment: Module 12<br>• *Work on project | 1 |
| 13 | Dec 7 | Conditional Logistic Regression | • Agresti, 5.4, 8.2 | • Recorded Lecture | • Assessment: Module 13<br>• *Study/Prepare for Review Session<br>• Finish Project & Submit | 16 |
| 14 | Dec 14 | Review |  | • Review Sample Final Solutions | • *Study | (30) |
| 15 | Dec 21 | FINAL | • A good book or movie! |  |  |  |

\* These items in column "Weekly Assessments" are listed here to encourage you to prepare for the following class and/or encourage sound time management. There is nothing to "hand in" the following Wednesday for these items.

**ATTENDANCE.** Attendance at all class session is expected. I will send around an attendance sheet at each class. If you are not present, you will miss information. The option to temporarily attend virtually will only be available for those with appropriate documentation (i.e., a doctor's note). Business meetings, work obligations, childcare, etc. are not allowable excuses to attend virtually.
**Exams are given on the dates indicated above.** No exams will be given early to accommodate vacation or personal schedules.

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## ASSIGNMENT STANDARDS

**Administration of Exams.** Exams will be administered during class time on the date indicated on the syllabus. You are required to bring your laptop and a calculator with you to class in order to take the exams. Please see the SPH webpage regarding the SPH requirements for computing accessibility (https://sph.rutgers.edu/student-life/computer-requirements.html).

**Lateness.** Assignments turned in after the official collection period are considered late. Assignments are to be posted to Canvas by the due date. Late assignments will assign a grade of zero.

**Extra Credit.** NO extra credit opportunities will be offered.


## SCHOOL POLICIES

**Learning Management System:** Canvas will be used extensively throughout the semester for course syllabus, assignments, announcements, communication and/or other course-related activities. It is the student's responsibility to familiarize themselves with Canvas and check it regularly. If you have difficulties accessing Canvas, please inform the instructor and Canvas Support (help@canvas.rutgers.edu). Canvas is accessible at canvas.rutgers.edu.

**School of Public Health Honor Code:** The School of Public Health Honor Code is found in the School Catalog (sph.rutgers.edu/academics/catalog.html). Each student bears a fundamental responsibility for maintaining academic integrity and intellectual honesty in his or her graduate work. For example, all students are expected to observe the generally accepted principles of scholarly work, to submit their own rather than another's work, to refrain from falsifying data, and to refrain from receiving and/or giving aid on examinations or other assigned work requiring independent effort. In submitting written material, the writer takes full responsibility for the work as a whole and implies that, except as properly noted by use of quotation marks, footnotes, etc., both the ideas and the works used are his or her own. In addition to maintaining personal academic integrity, each student is expected to contribute to the academic integrity of the School community by not facilitating inappropriate use of her/his own work by others and by reporting acts of academic dishonesty by others to an appropriate school authority. It should be clearly understood that plagiarism, cheating, or other forms of academic dishonesty will not be tolerated and can lead to sanctions up to and including separation from the Rutgers School of Public Health.

**Students with Disabilities:** Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student must apply for Services by first completing a Registration Form with the Rutgers Office of Disability Services (ODS) at ods.rutgers.edu. The student will also be required to participate in an ODS intake interview and provide documentation. If reasonable accommodations are granted, ODS will provide you with a Letter of Accommodations which should be shared with your instructors as early in your courses as possible.

**Commitment to Safe Learning Environment**: The Rutgers School of Public Health is committed to helping create a safe learning environment for all students and for the School as a whole. Free expression in an academic community is essential to the mission of providing the highest caliber of education possible. The School encourages civil discourse, reasoned thought, sustained discussion, and constructive engagement. Provocative ideas respectfully presented are an expected result. An enlightened academic community, however, connects freedom with responsibility. The School encourages all students to disclose any situations where you may feel unsafe, discriminated against, or harassed. Harassment or discrimination of any kind will be not tolerated and violations may lead to disciplinary actions.

**Reporting Discrimination or Harassment:** If you experience any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking, know that help and support are available. You may report such incidents to the RBHS Title IX Office or to the School of Public Health's Office of Student Affairs. Rutgers University has staff members trained to support survivors in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, and more. If you experience any other form of discrimination or harassment, including racial, ethnic, religious, political, or academic, please report any such incidents to the School's Office of Student Affairs. The School strongly encourages all students to report any incidents of discrimination or harassment to the School. Please be aware that all Rutgers employees (other than those designated as confidential resources such as advocates, counselors, clergy and healthcare providers as listed in Appendix A to Policy 10.3.12) are required to report information about such discrimination and harassment to the School and potentially the University. For example, if you tell a faculty or staff member about a situation of sexual harassment or sexual violence, or other related misconduct, the faculty or staff member must share that information with the RBHS Title IX Coordinator. If you wish to speak to a confidential employee who does not have this reporting responsibility, you can find a list of resources in Appendix A to University Policy 10.3.12. For more information about your options at Rutgers, please visit Rutgers Violence Prevention and Victim Assistance.

**Graduate Student Computer Policy:** Students are required to possess a personal laptop, no older than approximately two years, that must meet minimum requirements which may be found online at: sph.rutgers.edu/student-life/computer-support.html

**Policy Concerning Use of Recording Devices and Other Electronic Communications Systems:** When personally owned communication/recording devices are used by students to record lectures and/or classroom lessons, such use must be authorized by the faculty member or instructor who must give either oral or written permission prior to the start of the semester and identify restrictions, if any, on the use of mobile communications or recording devices.

**Policy Concerning Use of Turnitin:** Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com (directly or via learning management system, i.e. Canvas) for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Usage Policy posted on the Turnitin.com site. Students who do not agree should contact the course instructor immediately.

**Withdrawal/Refund Schedule:** Students who stop attending their course(s) without submitting a completed Add/Drop Course form will receive a failing grade. Furthermore, students dropping to zero credits for the semester are considered withdrawn and must submit a completed Leave of Absence form from the School of Public Health's Office of Student Affairs. The School of Public Health refunds tuition only. Administrative and technology fees are non-refundable. You may find the Withdrawal/Refund Schedule on the School of Public Health website at: sph.rutgers.edu/academics/academic-calendar.html

**Student Well-Being:** The School of Public Health recognizes that students may experience stressors or challenges that can impact both their academic experience and their personal well-being. If the source of your stressors or challenges is academic, students are encouraged to discuss these challenges and circumstances with their instructor, if they feel they may need additional support or temporary accommodations at the beginning or during this course. The course instructor may consider making reasonable temporary adjustments depending on the student's situation. For personal concerns or if additional support is needed, students may reach out to the Office of Student Affairs (studentaffairs@sph.rutgers.edu) or any of the appropriate referral resources listed on the SPH Student Connect Canvas page.

**Overview of School Policies:** Academic and non-academic policies and procedures, such Auditing a Course, Retaking Courses, Grade Grievance and others that cover registration, courses and grading, academic standing and progress, student rights and responsibilities, graduation and more may be found under Policies on the School of Public Health website. Below are select specific policies; however, students are responsible for keeping informed about academic and non-academic policies and procedures beyond those noted on this syllabus.