Course Title:  Applied Categorical Data Analysis  
Course Number:  BIST 0615  
Course Pre- and Co-requisite(s):  PHCO 0504 Introduction to Biostatistics,  
BIST 0535 Biostatistical Computing or BIST 0625 Fundamentals of Biostatistics  
BIST 0610 Advanced Regression Methods for Public Health Students  
Course Location:  3A/B (Busch), 1 Riverfront Plaza, Rm 1022 (Newark)  
Course Date & Time:  Wednesdays, 6-8pm  
Course Instructor:  Yaoyuan Vincent Tan, PhD, Postdoctoral Appointee,  
yvt4@sph.rutgers.edu, SPH Suite 213-A, Piscataway  
Office Hours:  Wednesdays starting from September 11, 4.30-5.30pm¹, Location:  
SPH 116 (Piscataway), 1010A (Newark). See footnote for dates at Newark. We do not have room 116 for September 11 and September 25 so do plan accordingly.  
Course Assistant:  Wei Wang², MS, PhD candidate, ww249@sph.rutgers.edu, SPH Suite 306-C, Piscataway  
Course Website:  https://rutgers.instructure.com/courses/31236  
Course Description:  Public health studies, especially those involving questionnaires, contain large amounts of categorical data. This class provides an introduction to 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 and/or R (Biostatistics students will be expected to know and use R in addition to SAS)  

¹ Dates for office hours are: Sep 11, Sep 18, Sep 25, Oct 2, Oct 9, Oct 16, Oct 23, Oct 30, Nov 6, Nov 13, Nov 20, Dec 4, and Dec 11 at Piscataway and also available on Webex.  
² Wei will be in Newark for the following days: Sep 11, Oct 2, Oct 9, Oct 30, Nov 20, Dec 11, and Dec 18. On Sep 11, Oct 2, and Oct 30, he will be there from 4.30pm – 5.30pm. On Oct 9, Nov 13, Dec 11, and Dec 18, he will be there from 4.30pm – 8pm.
Selected Concentration Competencies Addressed: The competencies addressed in this course for the MPH for the Department of Biostatistics include:

- Integrate relevant scientific background to design experimental and observational studies in biomedical, clinical and public health research;
- Use statistical computer packages to organize, analyze and report collected data;
- Apply basic probability theory and standard statistical methods to biomedical, clinical and public health research;
- Review and critique statistical methods and interpretations presented in published research studies, presentations or reports; and
- 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:

- Formulate appropriate statistical hypotheses for examining cross-classified data from public health and clinical studies
- Justify the basic theoretical models for categorical data
- Create and/or actively participate in the design and analysis plan for a study involving categorical data, whether nominal or ordinal in nature
- Conduct and/or actively participate in the analysis of categorical data
- Interpret results from contingency tables or generalized linear models that evaluate relationships between categorical variables

Course Requirements and Grading:

- Your grade will be determined according to the following assignments:
  1. Attendance/participation 5%
  2. Homework 10%
  3. Exams 40%
  4. Interim project presentation 10%
  5. Project presentation 15%
  6. Final Project Write-Up 20%
  Total: 100%

- Grading Policy:
  94 – 100 A
  90 – <94 A-
  87 – <90 B+
  84 – <87 B
  80 – <84 B-
  77 – <80 C+
  70 – <77 C
  <70 F
Homework policies

1. Homework can be turned in: 1. During class; 2. In my mailbox – Piscataway SPH 2nd floor (you will have to bear the risk if anything happens to it); or 3. Via email to Wei or me.
2. Please make sure that you submit your homework through either of these means before 2359 EDT of the due date.
3. On all homework assignments/problem sets, students are encouraged to discuss with one another, but work should be carried out and written up independently. If any two identical write-ups are found, both homework assignments will be given a grade of zero.
4. The homework assignments will involve computer work using SAS (and R for Biostatistics students). Relevant portions (only) of the output should be cut and pasted into the homework assignment at the appropriate spot, not attached at the end. Failure to comply will result in a reduction of 50% of points for that homework.
5. Homework solutions will be posted on Canvas 1 day after the due date.
6. Homework due dates are as follows:
   a. Homework 1 – September 13
   b. Homework 2 – September 20
   c. Homework 3 – September 27
   d. Homework 4 – October 4
   e. Homework 5 – Submission not required
   f. Homework 6 – October 25
   g. Homework 7 – November 1
   h. Homework 8 – November 22
   i. Homework 9 – Submission not required

Exam policies:

Exams will be given on October 9 and December 18. Any unexcused absences for these exams will result in a grade of zero for that exam.

FERPA issues:

Grades may only be released to the student by the registrar, in person or via a rutgers.edu email address by the instructor. Grades may not be released over the phone or posted publicly in any way.

Course Schedule:
<table>
<thead>
<tr>
<th>Date and Location</th>
<th>Main Lecture</th>
<th>Supplementary materials**</th>
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| **September 4**  | *Vincent – Busch*  
  **Introduction, Distributions and Sampling**  
  Definitions, Poisson, Binomial and Multinomial Distributions  
  Inference about univariate proportions  | MLE, LRT, Score tests, and Wald tests. 43:44 |
| **September 11** | Vincent – Busch  
  Wei – Newark  
  **Two-way Contingency Tables**  
  Probability Structures for 2-way tables, Chi-square tests of independence  
  Comparing proportions, risk ratios and odds ratios  | Sampling distributions, Exact tests, and Delta method. 32:26 |
| **September 18** | Vincent – Busch  
  **Two-way Contingency Tables with Ordinal Data**  
  Continuous or Categorical? Testing independence for ordinal data  
  Measures of Association for ordinal data  | Relationship between sampling methods. 30:07 |
| **September 25** | Vincent – Busch  
  **Three-way Tables**  
  Justification for studying three-way relationships, partial association, Cochran-Mantel-Haenszel Methods, Common odds ratios  | Bayesian analysis in categorical data. 54:22 |
| **October 2**    | Vincent – Busch  
  Wei – Newark  
  **Analyses for Matched Pairs of Categorical Data**  
  Defining the hypothesis of interest, Testing independence  | Sensitivity, Specificity, and local odds ratio. 30:01 |
| **October 9**    | Vincent – Busch  
  Wei – Newark  
  **MID-TERM** (Note October 14 is the last day to withdraw with a ‘W’) |
| **October 16**   | Vincent – Busch  
  **Generalized Linear Models**  
  Components of a generalized linear model, linear regression, models for binary data and Poisson regression Models for count and rate data, model inference and model fitting  | Poisson Loglinear model, Overdispersion, Quasi-likelihood, and GAM. 39:28 |
| **October 23**   | Vincent – Busch  
  **Logistic Regression**  
  Interpreting the logistic regression model, inference for logistic regression, model checking, logit models with qualitative and/or ordinal predictors, multiple logistic regression  | GLM estimation: Newton-Rhapson, Fisher Scoring, and IRWLS. 58:06 |
**October 30**  
Vincent – Busch  
Wei – Newark  

**Presentation of data set**  
Patricia Greenberg from RUBIES will present on the research question that she would like the class to work on. We will finish up what is left in previous classes or move on to a new topic in the 2nd half of the lecture.

**November 6**  
Vincent – Busch  

**Conditional Logistic regression and Generalized Estimating Equations**  
Introducing methods that might be relevant for project  
GEE details. 38:45

**November 13**  
Vincent – Busch  

**Interim presentation and Multi-category Logit Models**  
First half interim presentation. Second half - Logit Models for Nominal Responses, cumulative logit models for ordinal responses, paired-category logits for ordinal responses  
GLM diagnostics. 48:31

**November 20**  
Vincent – Busch  
Wei – Newark  

**Loglinear Models for Contingency Tables**  
Loglinear models for two- and three-way tables, inference for loglinear models, loglinear models for higher dimensions, the loglinear-logit connection  
Loglinear model link with logit. 33:26

**November 27**  
NO CLASS (Day before Thanksgiving)

**December 4**  
Vincent – Busch  

**Loglinear Models and Poisson Regression**  
Model building, test of linear association, and relation of linear association test to Cochran-Mantel-Haenszel Methods  
Rates and Survival analysis using Loglinear models. 27:00

**December 11**  
Vincent – Busch  
Wei – Newark  

**Project presentation**

**December 18**  
Vincent – Busch  
Wei – Newark  

**FINAL EXAM/ Final Report Due**

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*Note that if there are less than 5 students at Newark, students based in Newark are welcome to take the course in Piscataway or you can take the course from Newark with the understanding that I will be teaching from Piscataway.

**In total, excluding Thanksgiving and Final exam, we should have 14 weeks of contact time. This implies that we have 14*30mins=420mins of online contact time. In total, we have more than 432mins of contact time in total. This should be sufficient enough material for students to have a better grasp of this topic.*
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 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