Syllabus (09/2018 – 11/2018)

Course Title: Research Methods in Healthcare: A Comprehensive Approach

Course Number: ED 201R

Course Location: Lectures in RM 204, Rutgers University-New Brunswick, Busch Campus, Allison Road Classroom Building, Piscataway, NJ 08854 (Location is tentative. May change to a different room/building based on availability, but will stay on Busch Campus. Students will be notified at least a week in advance if there are any changes.)

Course Date & Time: Session 1: Saturdays (09/08 – 11/10); 8:30 AM – 12:00 PM
Session 2: Sundays (09/09 – 11/11); 8:30 AM – 12:00 PM

Course Instructor: Aayush Visaria, MPH
adv32@njms.rutgers.edu & (609) 216 1277

Office Hours: All questions can be addressed to Aayush and he will respond within 24 hours. Course questions not pertaining to the content should be addressed to ed2edtutor@gmail.com .

Course Advisers: Several Rutgers faculty and practicing physicians will be reviewing and providing feedback for students' independent research projects throughout the course period. Each student will be assigned a faculty member and physician to ensure proper statistical methodology and clinical reasoning for his/her research.

Required Course Text: None. All texts will be supplied at the first class.
Required Materials: Students must bring their own laptop and be able to download SAS and R programming languages on it during the first class.

Additional/Supplemental Readings/Resources:

(1) Smith, J. and Cody, R. (2006). Applied Statistics and the *SAS*® Programming Language, 5th Ed. Prentice Hall, NJ
(2) Kleinbaum, D., Kupper, L., Muller, K., and Nizam A. (2008). Applied Regression Analysis and Other Multivariable Methods, 5th Ed. Duxbury Publisher

Course Description: This course introduces students to a wide field of data-driven research using large survey healthcare datasets. Students will learn the basics of comprehensive literature reviews, cross-sectional survey datasets, statistical analysis, and statistical programming. Subsequently, they will develop their own research hypothesis, write a literature review, obtain experience writing statistical programming code, and conduct robust statistical analyses to test their hypothesis. All research projects will culminate in a research poster that will be presented at a relevant conference and a potential peer-reviewed publication if the student chooses to pursue his/her research further.

Students will also be trained by North American Disease Intervention (NADI) to measure basic vital signs including blood pressure, blood glucose, pulse rate, and biometric values (BMI, fat percentage, grip strength) and learn about hypertension and diabetes from a clinical and theoretical standpoint. This training will not only help those pursuing the health professions but also those who

would like to obtain community service. All participants who pass the NADI clinical assessment can sign up for NADI screening events* where they will directly interact with patients and take their vital signs. Please visit www.NADIaid.org for more details and to see many pictures of the some of the screening events we have had in the past.

*Students who wish to volunteer in the screening events must be 18 or older; however, anyone can be trained.

Why should you take this course? Excelling high school students and college students are often not exposed to research within their course curricula, even though they may have the skillset and interest to do so. Although wet lab research and high-cost clinical trials cannot be done without grant support and a university setting, secondary data analysis is an area that is accessible to all. Research no longer is only for those who are doing their PhDs or those who are the top of their class. This course aims to teach students an easy approach to doing high-level hypothesis-driven research. It is interdisciplinary, teaching students computer programming, statistics, and clinical reasoning, all while conducting research that can potentially impact future healthcare. Data research is an important part of any health professional's life, so it is important to have the toolset and mindset to conduct one's own research and analyze others' research. You will also get a chance to impact others' lives immediately by learning to take and interpret vital signs and by participating in our diverse clinical screening events.

By the end of the course, you will be able to:

Integrate relevant scientific background to design experimental and observational studies in biomedical, clinical and public health research;

Use statistical computer packages (SAS and R) to organize, analyze and report collected data;

Communicate the results of statistical studies both in writing and orally to investigators and lay community members.

Learn to measure blood pressure, blood sugar, among other vital signs, and be able to communicate results to patients while providing preventative education at health screening events.

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Course Schedule: This table provides a general plan for the course; some deviations may be necessary. The schedule for Session 2 is the exact same, with only the dates changed to Sundays.

Date	Class Activities	Homework
Week 1 (9/08)	Introduction to the course. Hand out materials (blood pressure kit, SAS text, research methods text). NADI Vital Signs training sessions. Using survey datasets.	Choose and become acquainted with a dataset. Review statistical principles. Start reading literature about your topic(s) of interest.
Week 2 (9/15)	NADI Vital Signs Assessment. Review of statistics. Scientific Method and Literature Reviews.	Narrow down topic of interest to one specific topic. Determine independent and dependent variables. Read and dissect 10 related research papers.
Week 3 (9/22)	Complete literature review process. Begin developing hypothesis and consolidating outcome and exposure variables of interest. Use SAS to narrow confounding factors.	Finish writing literature review. Use SAS to complete Table 1 as discussed.
Week 4 (9/29)	Developing study population. Inclusion and Exclusion criteria. Common medications, high-risk and susceptible populations.	Write Study Population section of methods section of research paper.
Week 5 (10/6)	Normality and assumptions for statistical tests. Lecture about clinical research.	For any assumptions not met, correct if possible. Continue reading clinical papers related to your topic.
Week 6 (10/13)	Introduction to PROC SURVEY_ and more advanced biostatistics	Complete homework problems and determine which tests / models are to be implemented for your own project.
Week 7 (10/20)	Model selection and p-value interpretation.	Complete SAS or R code for model selection.
Week 8 (10/27)	Odds Ratios, Relative Risk, Prevalence Rate Ratios	Complete SAS or R code for calculation of PRRs and their confidence intervals.
Week 9 (11/3)	Stratified analyses and continuous-to-categorical analyses	Prepare for oral presentation (2 minutes each) as discussed. Review physician feedback.
Week 10 (11/10)	Final code modifications and submission of paper. Presentations. Feedback from instructor.	Review feedback given on statistical analysis by professor and instructor. Prepare for STS Competition.

Ed2Ed Tutoring Honor Code: 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 or results, and

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Example of Completed Research Poster. Student recently submitted the research article to JAMA.

Differences in Hypertension Prevalence Between Rural and Urban Populations in India

Aayush Visaria[1,3], MPH, Aditya Chauhan[1], Pamela Ohman-Strickland[2], PhD

North American Disease Intervention (NADI); Rutgers School of Public Health, Department of Biostatistics; Rutgers New Jersey Medical School

BACKGROUND

- Worldwide, an estimated 1.4 billion adults have hypertension. Nearly 1 in 3 have hypertension and another 1 in 3 are pre-hypertensive. There is an increasing disparity in hypertension prevalence between high-income countries (e.g. United States) and low-income countries (e.g. India).
- Despite its large global burden, hypertension is a preventable and manageable condition.

Blood Pressure Components

Two components comprise blood pressure: a systolic blood pressure (SBP) and diastolic blood pressure (DBP).

Blood pressure is largely determined by aortic compliance (ability to distend upon increase in blood volume) and ventricular stroke volume.

- **Systolic pressure** is the peak aortic pressure when ventricles contract.
- **Diastolic pressure** is from the elastic recoil of arteries during ventricular relaxation.
- **Pulse Pressure** is systolic pressure – diastolic pressure. It is a measure of aortic compliance (see *Figure 1 and 2*)
- **Mean Arterial Pressure** is determined by cardiac output (CO) and systemic vascular resistance (SVR)
  - **MAP = (CO × SVR) + CVP**

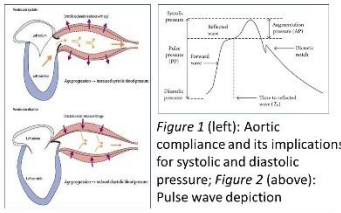


Figure 1 (left): Aortic compliance and its implications for systolic and diastolic pressure; *Figure 2* (above): Pulse wave depiction

RESEARCH QUESTIONS

1. What is the prevalence of hypertension and various risk factors by state, gender, and rural/urban environment?
2. Is there a significant difference in proportion of hypertension between rural and urban Indians?
3. Among hypertensives, what proportion of them have Isolated Systolic Hypertension (ISH), Isolated Diastolic Hypertension (IDH), and Systo-Diastolic Hypertension (SDH)?
4. Is there a pattern of hypertension types by age that can be explained by lifestyle?

METHODS

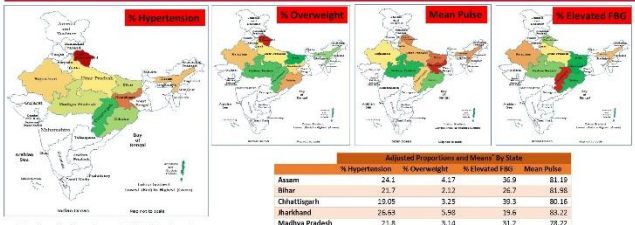
Study Methodology

- The 3rd **Annual Health Survey** is a representative survey that was administered by the Government of India to over 18 million individuals in 2014. It follows a uni-stage simple random sample across 9 high-focus states (Assam, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttar Pradesh, and Uttarakhand).
- In 2014, a **Clinical, Anthropometric, and Biochemical (CAB) Survey** was initiated with the goal to better understand the distribution of elementary health measures including blood pressure, fasting blood glucose, pulse rate, weight, height, among others.
- Prevalence rates are compared to prevalence rates from the **National Health and Nutrition Examination Survey (NHANES) 2013-2014**, a CDC-based U.S. nationally representative survey.

Statistical Analysis

- A total of 894,668 adult, non-pregnant subjects from nine states were included in the study. Prevalence rates were determined using multivariate conditional logistic regression models for categorical variables (e.g. hypertension – yes/no) or multivariate linear regression models for continuous variables (e.g. mean pulse rate). Statistical significance was set at 0.05.

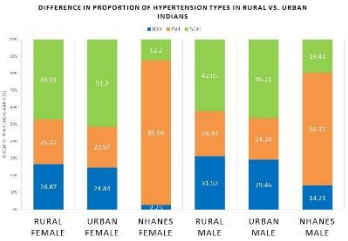
RESULTS



Hypertension is most prevalent in Uttarakhand, where the mean SBP is 130 and least prevalent in Chattisgarh where the mean SBP is 123. Risk factors are not significantly correlated at a state-level. For example, Chattisgarh has the highest proportion of adults with elevated fasting blood glucose. Out of all the states, Odisha has the lowest overall prevalence of hypertension and risk factors, while Uttarakhand and Jharkhand have the most.

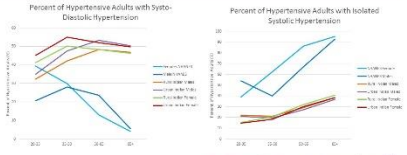
Adjusted Proportions and Means* By State				
	% Hypertension	% Overweight	% Elevated FBG	Mean Pulse
Assam	24.1	4.17	36.9	81.19
Bihar	21.7	2.12	26.7	81.98
Chhattisgarh	19.05	3.25	39.3	80.16
Jharkhand	26.63	5.98	19.6	88.22
Madhya Pradesh	21.8	3.14	31.2	78.22
Odisha	20.97	7.44	27.4	78.73
Rajasthan	23.35	6.67	37.2	79.67
Uttar Pradesh	22.5	5.57	36.1	80.5
Uttarakhand	30.88	11.08	32.8	81.36
P-value**	<0.0001	<0.0001	<0.0001	<0.0001

*- All proportions and means listed are adjusted for sex, age, and percent rural population using multivariate linear effects model.
**- P-value was calculated using ANOVA and represents the overall difference between states.
Hypertension was defined as either SBP >= 140 and/or DBP >= 90. Overweight was defined as BMI > 27 kg/m^2. Elevated Fasting Blood Glucose (FBG) was defined as plasma glucose > 100 mg/dl.

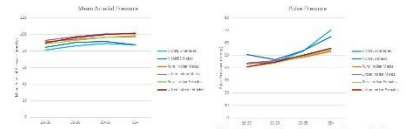


- At a country level, a higher proportion of hypertensive Indian adults have IDH and SDH than American counterparts (p<0.001).
- A greater proportion of rural Indians have ISH and IDH than urban Indians (p<0.001).
- Females have higher proportion of SDH than males (p<0.001).

RESULTS



- Decrease in IDH with age
- While rural and urban Indians' SDH proportion level off, NHANES proportion of SDH decreases
- Urban Indians have higher proportion of SDH than rural Indians
- Increase in ISH with age
- Rate of increase of ISH proportion from age 35 onwards increases
- No difference in ISH between rural and urban Indians, but large, significant difference between NHANES and AHS data.



Mean Arterial Pressure is significantly greater in urban Indians than both rural Indians and NHANES population (p<0.001)

Rate of increase in pulse pressure is greater in NHANES population than rural or urban Indian populations. No significant difference between rural and urban populations (p=0.5067)

DISCUSSION

- **There is a clear changing distribution of hypertension types with increasing age.** Even after adjusting for risk factors such as obesity, diabetes, anemia, and tachycardia, the elevated rate of increase in ISH after age 35 across all groups is still significant, suggesting a possible physiological, general mechanism of aging.
- Obese Indian individuals (BMI > 27) have a greater proportion of SDH than normal BMI adults. Underweight adults have a significantly lower proportion of SDH.
- **Rural Indians have lower mean blood pressure, pulse rate, BMI, and fasting blood glucose than their urban counterparts, likely due to different lifestyles.** However, mean arterial pressure for all Indians is still significantly higher than the American population, suggesting necessary intervention or at least surveillance.
- The difference in distribution of hypertension types between rural, urban, and NHANES groups suggests that environmental factors may play a role in getting a particular type of hypertension.
- Limitations include cross-sectional nature of data and lack of environmental, behavioral, and clinical measures to assess effect of diet and metabolite levels on distribution of hypertension types.

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