

Mentoring undergraduate researchers

Preparing to Teach 2022

Yue Jiang

A disclaimer

The following material was used during a live session. Without the accompanying oral comments and discussion, the text is incomplete as a record of the presentation.

Agenda

1. Why?
2. How?
3. Discussion and Q&A

Why might students benefit?

When students engage in undergraduate research, they...

- ...answer questions and satisfy their own curiosity
- ...enrich their educational experience and learn beyond the classroom
- ...develop skills, both statistical and otherwise
- ...reinforce identities as statisticians and members of the scientific community
- ...build relationships with established professionals and future colleagues
- ...*get a leg up in future endeavors*

Why might faculty benefit?

When faculty serve as (research) mentors, they...






- ...improve their teaching skills
- ...gain the opportunity to teach new, interesting material
- ...advance their own scholarship and contribute to the body of knowledge
- ...shape the next generation of leaders
- ...*have a direct impact in a student's life*

What difficulties might we run into?

- Opportunities might be hard to find, especially for under-represented students
- Students might not have been exposed to very much - this might be their "first contact" with research
- It may be difficult to find an appropriate project for the student's level of preparation
- There might not be sufficient departmental or campus support/resources

How might we overcome some of these difficulties?

Mentoring Undergraduate Research in Statistics: Reaping the Benefits and Overcoming the Barriers

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ABSTRACT

Undergraduate research experiences (UREs), whether within the context of a mentor-mentee experience or a classroom framework, represent an excellent opportunity to expose students to the independent scholarship model. The high impact of undergraduate research has received recent attention in the context of STEM disciplines. Reflecting a 2017 survey of statistics faculty, this article examines the perceived benefits of UREs, as well as barriers to the incorporation of UREs, specifically within the field of statistics. Viewpoints of students, faculty mentors, and institutions are investigated. Further, the article offers several strategies for leveraging characteristics unique to the field of statistics to overcome barriers and thereby provide greater opportunity for undergraduate statistics students to gain research experience.

KEYWORDS

Active learning; Faculty survey; High-impact teaching practices; Recruitment and retention; Statistics education; Undergraduate statistics research

How can we serve as effective mentors?

Think back to your own experiences. What did you appreciate about their mentoring styles? How were they effective in shaping your path?

- Be kind
- Be available
- Be patient
- Be flexible
- *Have high standards!*

Remember that you are not limited to being a mentor only in the context of statistics.

How can we serve as effective mentors?

- Set concrete expectations
- Encourage resilience and healthy approach to mistakes
- Promote (scaffolded) independence

How can we serve as effective mentors?

3. Nature of the Final Product:

The final product will be a research report detailing the background, methods, results, and conclusions of the work, in addition to a research poster to be presented to the public and to a private thesis committee. If time permits, the report will be developed into a complete manuscript that will be submitted to an academic research journal.

4. Scheduled Meetings and Work Expectations:

Weekly substantive research meetings will be held with the advisor, with regular communication regarding updates expected. An anticipated timeline is as follows: literature review, data collection, data cleaning, and initial exploratory data analysis will be finished by February. Data analysis and initial draft preparation will be finished by March. Manuscript submission is targeted for the end of the semester, with further revisions as needed depending on review feedback and timelines. Research poster and presentation will be completed by the six-week deadline prior to the semester's end.

How can we serve as effective mentors?

5. Grading Criteria:

A range - Weekly progress met or exceeded expectations at the course level of the independent study without prompting; student is able to implement methods, correctly interpret and accurately communicate results; the end product is an academic paper of suitable quality and standards to be published in top-tier journals (e.g., Journal of Communication, New Media and Society, American Sociological Review, etc.). The student met the highest expectations of research integrity and ethics and provided reproducible code corresponding to the final product.

B range - Weekly progress usually met expectations at the course level of the independent study or required only minor prompting; student is mostly able to implement methods and correctly interpret and accurately communicate results, but one or more of those areas does not fully meet the expectations outlined in the proposal; interpretation and communication of results is not fully correct, such that there are substantive issues with the final manuscript. The end product is an academic manuscript, but might be suitable for inclusion in an academic journal only if many substantive revisions must be made by the advisor. The student met the highest expectations of research integrity and ethics.

C range or lower - Weekly progress often did not meet expectations at the course level of the independent study; student has not independently implemented methods or correctly interpreted and accurately communicated results. The final product / write up is poor and not suitable for submission to a high-quality academic journal.

How can we serve as effective mentors?

3. Nature of the final product:

I will report the results from this independent study in a manuscript to be submitted for publication in journals such as *American Journal of Epidemiology*, *American Journal of Preventive Medicine*, *Journal of Addiction Medicine*, etc.

4. Scheduled meetings and work expectations:

I will attend weekly check-in meetings (30 minutes) with my faculty mentor Dr. Yue Jiang to provide updates and receive feedback. We will schedule additional meetings as needed. On a weekly basis, I plan to dedicate around 8-10 hours to work on the project.

How can we serve as effective mentors?

6. Reading list:

- Brady, K. T., McCauley, J. L., & Back, S. E. (2016, January). Prescription opioid misuse, abuse, and treatment in the United States: An update. *The American journal of psychiatry*.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4782928/>.
- Brorson, H. H., Ajo Arnevik, E., Rand-Hendriksen, K., & Duckert, F. (2013). Drop-out from addiction treatment: a systematic review of risk factors. *Clinical psychology review*, 33(8), 1010–1024.
<https://doi.org/10.1016/j.cpr.2013.07.007>
- Collett, D. (2015). *Modelling survival data in medical research*. CRC Press, 3rd ed. ISBN 9781439856789.
- Hahn, K. L. (2011, March). Strategies to prevent opioid misuse, abuse, and diversion that may also reduce the associated costs. *American health; drug benefits*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4106581/>.
- HHS. (2017, October 26). HHS Acting Secretary Declares Public Health Emergency to Address National Opioid Crisis. HHS.Gov. <https://www.hhs.gov/about/news/2017/10/26/hhs-acting-secretary-declares-public-health-emergency-address-national-opioid-crisis.html>
- National Institute on Drug Abuse. (2020, May 27). Opioid Overdose Crisis. <https://www.drugabuse.gov/drug-topics/opioids/opioid-overdose-crisis>
- National Institute on Drug Abuse. (2021, April 13). Part 1: The connection between Substance Use Disorders and mental illness. National Institute on Drug Abuse. <https://www.drugabuse.gov/publications/research-reports/common-comorbidities-substance-use-disorders/part-1-connection-between-substance-use-disorders-mental-illness>.
- Scholl L, Seth P, Kariisa M, Wilson N, Baldwin G. Drug and Opioid-Involved Overdose Deaths — United States, 2013–2017. *MMWR Morb Mortal Wkly Rep* 2019;67:1419–1427. DOI: <http://dx.doi.org/10.15585/mmwr.mm675152e1>
- Stahler, G. J., & Mennis, J. (2018). Treatment outcome disparities for opioid users: Are there racial and ethnic differences in treatment completion across large US metropolitan areas?. *Drug and alcohol dependence*, 190, 170–178.
<https://doi.org/10.1016/j.drugalcdep.2018.06.006>
- Substance Abuse and Mental Health Services Administration, Treatment Episode Data Set (TEDS): 2018. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2021.

How can we serve as effective mentors?

7. Research sources and methods:

For this independent study, I will analyze the Treatment Episode Data Set (TEDS) from the Substance Abuse and Mental Health Services Administration (SAMHSA) under the Department of Health and Human Services (HHS). The dataset is collected annually by states for the purposes of monitoring their substance use treatment systems. There are two separate systems within TEDS that each records the incidences of treatment admission and discharge in a given year (SAMHSA, 2021). In this study, we will use the treatment episode discharge dataset from the year 2019 to conduct a cross-sectional analysis. From there, we only included the records where the patient has been diagnosed with opioid dependence/abuse and opioid was their primary substance at the time of admission. Each observation in the dataset represents a patient's treatment episode in state-licensed or certified substance use treatment centers. Currently, I have access to the data source from the SAMHSA website.

Approval from IRB is not required since the study is a secondary analysis of a publicly available, non-identifiable national dataset. I've completed the relevant RCR training module which encompasses 3 required training modules and 1 elective molecule named *Research, Ethics, and Society* (certificate attached at the end of the document). I will complete the RCR event requirement during the semester.

How can we serve as effective mentors?

-----Original Message-----

From: [REDACTED] <onbehalf@manuscriptcentral.com>

Sent: Wednesday, August 3, 2022 9:44 AM

To: Yue Jiang <yue.jiang@duke.edu>

Subject: Decision on Manuscript ID [REDACTED]

03-Aug-2022

Dear Dr. Jiang:

I write you in regards to manuscript # [REDACTED]
[REDACTED]

I have now had a chance to read through your manuscript and I am sorry to inform you that your manuscript has been denied further consideration for publication in [REDACTED]. While I greatly appreciate your efforts with this manuscript, and encourage you to continue this interesting work, I expect our reviewers will find that the manuscript requires considerably more development and advancement of theory and that it is too descriptive in its present form.

Ultimately, given its scope, your manuscript is likely better suited to a journal with a focus on political communication than it is to [REDACTED].

Thank you for considering [REDACTED] for the publication of your research. I hope the outcome of this specific submission will not discourage you from the submission of future manuscripts.

Sincerely,
[REDACTED]

How can we serve as effective mentors?

Hi Yue,

Ah, that's unfortunate about [REDACTED] -- glad we didn't have to wait for weeks though! For journals with more involvement in political topics, I thought Political Communication, Policy and Internet, or Online Networks and Social Media looked like they might fit.

How might we include students in research?



Intro to Undergraduate Research in Statistical Science

Welcome!

Welcome! You are part of a program designed to increase your fundamental research skills and improve your ability to successfully join a research project, team, or lab and be productive. Conducting research is an important part of every industry and economic sector; it's not just an academic pursuit. New graduates in our department describe their research experiences as some of the most valuable parts of their undergraduate life at Duke. We're glad you have pursued this experience with us

How might we include students in research?

Day 1

Introduction

Today we meet the people in the workshop, begin working on team building and communications skills for research teams, and start to negotiate around our expectations.

Learning Outcomes

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

- identify the workshop staff and participants
- outline your expectations regarding research experiences in general and this one in particular
- discuss skills you can bring to the research team
- identify research skills you wish to develop
- discuss the impact of different communication styles on research team tasks and group process
- identify constructive and destructive group behaviors and consider their impact on past team experiences
- define a research mentor/mentee contract and begin adapting a draft contract for your team's project

How might we include students in research?

Learning Activities

Today's tasks include:

- Check-in on Google Sheet here: [Career Dreams](#)
- Introductions to workshop staff, team introductions and large group
- Research Reflections 1 document, pair and share, then teams discuss research expectations
- Communications Patterns: pair and share on what surprised you
- [Constructive and Destructive Group Behaviors](#).
- Short meeting to begin discussing mentor-team research contract
- You will have met twice with your team and had individual conversations with two members of the other team

Prep for Day 2

Short List of Tasks to complete before Day 2

- ☐ Upload the Research Reflections 1 Document to your dropbox here in Sakai. (arrows going two ways at top of tools icons)
- ☐ Complete the brief End of Day 1 Reflection in Tests and Quizzes.
- ☐ Get yourself a copy of this article from the Duke Library: Lee JD, Nunes EV Jr., Kovo P, et al. "Comparative effectiveness of extended- release naltrexone versus buprenorphine-naloxone for opioid relapse prevention (X:BOT): a multicentre, open-label, randomised controlled trial." Lancet. 2018 January 27; 391(10118): 309–318
- ☐ Skim that article. We'll dig into it in depth tomorrow.
- ☐ Skim the Project Intro you will find in Resources Tool.

How might we include students in research?

Day 7

Introduction

Today you will work in your group until noon. Then we will work on Receiving Feedback and on research Opportunities in the Department

Learning Outcomes

By the end of this day you will be able to:

- distinguish between a variety of research roles at Duke
- identify undergraduate research opportunities in the department of Statistical Science at Duke
- understand the role of constructive feedback
- communicate effectively across diverse backgrounds and cultures
- and you will have kept working on your project

How might we include students in research?

STA 440: Case Studies

STA 440 is an intensive applied course that asks you to analyze timely real-world data across diverse domains in a principled, data-driven way. There may be more than one reasonable approach for any given situation, and you may be introduced to new material and techniques you haven't yet seen. Along the way, you'll work with a team of peers, develop critical thinking and communication skills, develop best-practices in version-control and reproducibility, and strive to become a creative and well-rounded practicing statistician.

How might we include students in research?

Introduction

Since the 1990s, opioids have become an increasingly common method of pain management in Americans. However, the illicit misuse of opioids has led to a public health crisis known colloquially as the “opioid epidemic.” In 2017, almost 50,000 Americans died from an opioid overdose [1] and 1.7 million suffered from substance use disorders related to prescription opioids [2], contributing to an estimated total economic burden of \$78.5 billion a year [3].

Although drug rehabilitation programs are available to combat the physical and psychological dependency on opioid medications, patients often relapse even after successful therapy. Lee and Rotrosen et al. conducted a study to compare the effectiveness of two drug therapies intended to prevent opioid relapse during drug rehabilitation [4]. This case study is based on their study data, which was sponsored by the National Institute on Drug Abuse (NIDA).

Project objectives

Your goal is to provide a convincing statistical analysis comparing two treatments in the prevention of opioid-relapse after drug rehabilitation: extended-release naltrexone (XR-NTX) and buprenorphine-naloxone (BUP-NX). What is the difference, if any, between these two treatments in comparing the following factors:

- ...time-to-relapse after receipt of therapy,
- ...proportion of patients successfully inducted into therapy, and
- ...safety profile of the two treatments vis-a-vis adverse events?

Detailed instructions, the data, and data descriptions are available in the course [GitHub repository](#).

How might we include students in research?

Learning objectives

Case-specific goals:

- Become familiar with basics of clinical trial design and analysis
- Learn visualization, inference, and applied modeling of time-to-event outcomes
- Critically evaluate existing literature and compare work from disparate research teams.

Overall class goals:

- Solidify skills in reproducible research and programming, including version-control and collaboration via GitHub
- Critically think about reasonable analysis approaches in the context of real-world data
- Express statistical models clearly and correctly
- Develop scientific writing skills by providing clear, concise, data-driven conclusions suitable for allied researchers

Project timeline

- **Group:** Report, reproducible code, and video
 - Due Sunday, February 14
- **Individual:** Peer review and reproduction of results
 - Due Thursday, February 18
- **Group:** Revised report and response to reviewers
 - Due Tuesday, February 23
- **Individual:** Case team and peer reviewer evaluations
 - Due Thursday, February 25

Note: each team's GitHub report repository and commit history will also be evaluated by the instructor. The GitHub repository must contain the reproducible R Markdown document corresponding to the submitted reports, and will be checked throughout the course of the case study to ensure all team members are making meaningful contributions to the project.

How might we include students in research?

Project objectives

Your goal is to evaluate whether one-and-dones (i.e., players who played only one season of collegiate basketball before declaring for the draft) are more successful relative to their peers. As part of your analysis, you must examine both game-specific metrics as well as whether such players last longer in the league in terms of number of seasons played. Your analysis must address potentially confounders (e.g., physical characteristics, draft pick number, position played, etc.).

This case study was inspired by Frank Hu, who also compiled the data by scraping data from RealGM and Basketball Reference [4, 5]. Additional data cleaning was performed by the instructor.

Detailed instructions, the data, and data descriptions are available in the course [GitHub repository](#).

Project timeline

- **Group:** Report and reproducible code
 - Due Saturday, October 16
- **Individual:** Peer review and reproduction of results
 - Due Wednesday, October 20
- **Group:** Revised report and response to reviewers
 - Due Wednesday, October 27

Note: each team's GitHub report repository and commit history will also be evaluated by the instructor. The GitHub repository must contain the reproducible R Markdown document corresponding to the submitted reports, and will be checked throughout the course of the case study to ensure all team members are making meaningful contributions to the project.

How might we include students in research?

Introduction

Lemuroidea is a primate superfamily that contains around 100 species of primates commonly known as lemurs. Lemurs are a diverse group of animals, but unfortunately many species are endangered due to human activity. However, they are an important group of animals to research, as their taxonomic and physical characteristics can provide researchers greater understanding of human evolution.

The Duke Lemur Center, established over 50 years ago, is a renowned research institute that houses the most diverse population of lemurs outside of Madagascar. Since its inception, the Lemur Center has cared for over 4,000 animals, including 200 currently in its care. The Lemur Center is a world leader in conservation and preservation of primates, and as part of its research mission has made available detailed and verified life histories for over 3,600 animals.

Project objectives

Your goal is simply to identify whether there are systematic differences in longevity among and between lemurs. For instance, are there differences based on sex? Taxon? Time of year when the animals was born? Whether the animal was born in captivity? Etc. Your primary analysis should represent something of scientific or sociological interest to researchers, and account for potential confounders in any modeling approach.

Clearly write any model(s) using correct mathematical notation. Care should be made to use readily-interpretable models, with conclusions and interpretations able to be understood by allied researchers and the knowledgeable public.

Detailed instructions, the data, and data descriptions are available in the course [GitHub repository](#).

How might we include students in research?

Muser



Muser is changing the structure and culture of academic research at Duke so that undergraduate research opportunities from all disciplines are visible and accessible to all.


More than 3000 registered users and more than 470 authenticated mentors have participated in Muser since its founding at Duke. Join our effort to achieve accessible, transparent, equitable, and multidisciplinary research experiences for students and mentors.

Every round offers a new suite of undergraduate research positions from all disciplines.




Muser provides Duke students with regularly-scheduled, clearly articulated, and equitable access to research opportunities across all fields. Research mentors are members of the entire Duke University research community who can provide meaningful research experiences for students. Mentors are graduate students, postdocs, lab technicians, research team leaders, principal investigators, and professors.


How might we include students in research?

Create project




 ☆ Covid-19 Frontline Worker Study


This project involves data analysis about intensive care unit (ICU) healthcare work during Covid-19.

 3 sp. | 0 appl.  8-10  Social Sciences (+3)




 ☆ Efficient simulation of complex open quantum systems


In this project, the student will develop a computational method to study open quantum systems. An open quantum system is a quantum system coupled to a large bath/reservoir, and open quantum system

 1 sp. | 0 appl.  8-10  Multi/Interdisciplinary Studies (+4)




 ☆ Improving the performance and consistency of aerosol jet printed AgNPs

This project will take place in-person at the Franklin Lab during the Fall 2021 semester. Printing is one of the highest throughput and lowest cost fabrication approaches.

 1 sp. | 0 appl.  8-10 (+2)  Engineering (+6)

 ☆ Depositing nanomaterial-based inks through gravure printing

This project will take place in-person at the Franklin Lab during the Fall 2021 semester. Printing is one of the highest throughput and lowest cost fabrication approaches.

 1 sp. | 0 appl.  8-10 (+2)  Engineering (+6)

How might we include students in research?

Recurrent alcohol-related complications in bariatric surgery patients




Bariatric surgery is associated with increased risk of alcohol-related outcomes, with previous studies demonstrating increased risk of de novo alcohol-related complications among Roux-en-Y Gastric Bypass patients. However, certain bariatric surgeries may be associated with further, recurrent complications as well; the analysis of such recurrent events would serve to further elucidate any potential associations between such surgeries and alcohol-related outcomes.

The goal of the present study is to examine whether such relationships exist beyond the first instance of alcohol-related complications by using recurrent event analysis. We aim not only to examine this important clinical issue, but also to bring the statistical issue of recurrent events to greater attention of medical practitioners, to encourage them to think about such outcomes when designing studies, and to provide a tutorial in recurrent event methods.

Name of research group, project, or lab: Yue Jiang - Remote

What is the context and setting for this research?

This project will be a one-on-one mentored remote/virtual research experience with Dr. Yue Jiang of the Department of Statistical Science. The project will also involve collaborations with the Division of Gastroenterology and Hepatology of the UNC School of Medicine, particularly regarding domain-specific expertise and scientific/clinical matters.

Representative publication:  [example_abstract_Redacted.pdf](#)

How might we include students in research?

Logistics Information:

Project categories

📊 Statistics

Student ranks applicable

Junior, Senior

Student qualifications

Strong candidates will be rising juniors or seniors with extensive experience in applied statistical analysis using R or Python. Experience wrangling large administrative claims data and/or analyzing time-to-event data is desired but not necessary.

Hours per week

5-7, 8-10

Compensation

Paid - General

Paid - Work-Study Required

Unpaid - Ind. Study Credit

Unpaid - Volunteer

Number of openings

1

Techniques learned

Survival analysis, particularly in analysis of recurrent events.

Contact Information:

Mentor

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Assistant Professor of the Practice of Statistical Science

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How might we include students in research?

Guided independent studies / honors theses

Discussion and Q&A