

Undergraduate students: Mentoring and research involvement

Preparing to Teach 2021 (virtual)

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 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

Project objectives

Learning objectives

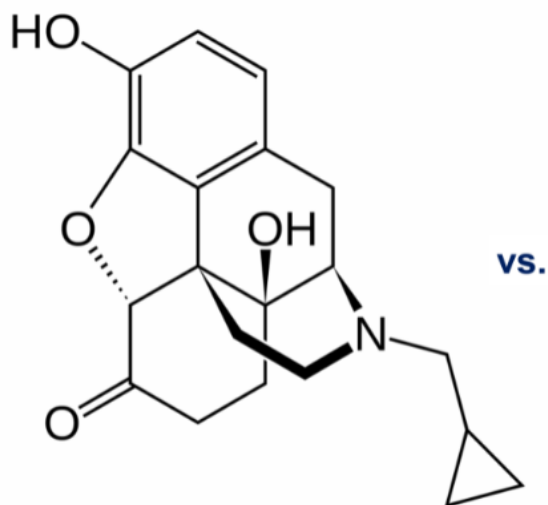
Project timeline

Extra credit opportunity

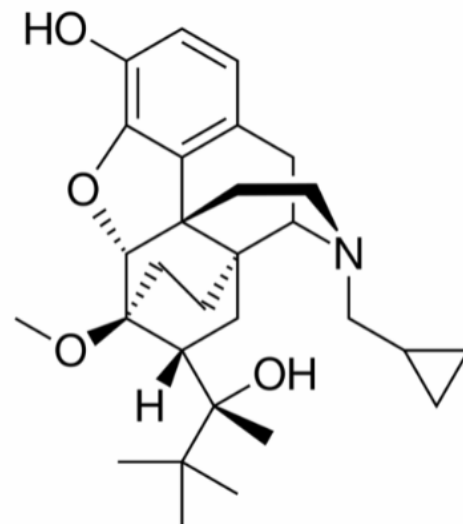
References

Case study 01: opioid relapse

STA 440 Spring 2021 (Jiang)



vs.



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?

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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How might we include students in research?

Guided independent studies / honors theses

Discussion and Q&A