

Naumova, Elena N.

Short Course Description:

This project-based course in advanced data analysis capitalizes on student interests to formulate research questions. We focus on understanding data limitations, conducting multi-stage data analysis, and utilizing proper data flow, analysis, and visualization tools. Students will learn modern analytical methods and techniques essential for data analysis in a range of disciplines such as Climate, Environment, Nutrition, and Health. This course also covers current issues in research design, the scientific method, data quality and validity, data management, and research ethics in data analysis. This course is a part of the NSF-funded study and will incorporate essential research components, including consenting, pre- and post- surveys, and pre- and post- assessment exercises (IRB-approved).

Course cross-listed as: CEE 194 Environmental Informatics

Syllabus

Tufts University, Friedman School of Nutrition Science and Policy

NUTR 394 – Advanced Data Analysis (ADA)

Fall 2021

Class Meetings*: (Mandatory)	<i>Mondays, 4:00 – 6:00pm EST, Weekly</i> <u>Attending in Person:</u> Friedman School, Jaharis Center, Room 105 <u>Attending Online:</u> Recurring Meeting Zoom Link +16465588656,,99489407419# (New York) (Direct Call In)
Practicum*: (Mandatory)	<i>Thursdays, 4:00 - 5:00pm EST</i> <u>Online Only:</u> Recurring Meeting Zoom Link +16465588656,,95671531295# (New York) (Direct Call In)
Office Hours: (Optional)	<i>Thursdays, 5:00 - 6:00pm EST</i> <u>Online Only:</u> Recurring Meeting Zoom Link +16465588656,,95671531295# (New York) (Direct Call In)

* Please note that Zoom links have been scheduled to begin 15 minutes before and end 15 minutes after scheduled times. Please log onto the Zoom link at least 5 minutes before the scheduled times above.

Instructor*: *Elena N. Naumova, PhD, Professor (Elena.Naumova@tufts.edu)*

Teaching Assistants*: *Ryan Simpson, PhD Candidate (Ryan.Simpson@tufts.edu)*
Bingjie Zhou, PhD Student (Bingjie.Zhou@tuft.edu)

* When contacting the teaching team, please direct your emails to all instructors and teaching assistants so that we may assist you as quickly and accurately as possible.

Graduate Credits: *3 Semester Hour Units (SHUs) – former 1 credit*

Prerequisites: Students should have basic working knowledge of statistical methods in epidemiology and nutrition and/or environmental research. Recommended courses that cover those topics include:

- Biostatistics / Statistical Methods for Nutrition I and II (NUTR 206/309);
- Statistical Methods for Public Health Professionals I and II (NUTB 250/350);
- Statistical Methods in Nutrition Research and Regression Analysis for Nutrition Policy (NUTR 207/NUTR 307);

or equivalent. Ability to analyze data by use of R is preferable, but students may utilize other statistical programs as long as those programs are sufficient for analyses proposed.

Pre-Course Expectations: Students should attempt to identify datasets relevant to their specific interests prior to the course. The instructor and teaching assistant will approve dataset suitability. If students cannot identify appropriate datasets, please use our compiled resources at [Canvas > Files > Practicum](#), which is also available in Module 0 on Canvas.

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Course Objectives:

a. Outcomes Addressed by the Course:

- Identify, formulate, and solve analytical problems.
- Demonstrate knowledge of contemporary issues relevant to data analyses.
- Use techniques, skills, and modern analytical tools necessary for Climate, Environment, Nutrition, and Health applications.

b. Specific Outcomes of Instruction:

- Learn how to formulate research hypotheses.
- Learn how to justify research hypotheses with the proper evidence and support.
- Understand and learn how to prepare data for advanced analyses.
- Learn how to design a data flow for testing multiple research hypotheses.
- Learn how to perform intermediate statistical and analytical techniques.
- Use standard analytical tools to test statistical hypotheses and interpret results.
- Understand principles of research ethics to conduct responsible data analyses.
- Obtain knowledge and articulate underlying principles of data analysis in application to Climate, Environment, Nutrition, and Health.

Accommodation of Disabilities: Tufts University is committed to providing equal access and support to all students through the provision of reasonable accommodations so that each student may access their curricula and achieve their personal and academic potential. If you have a disability that requires reasonable accommodations, please contact the Friedman School Assistant Dean of Student Affairs at 617-636-6719 to make arrangements for appropriate accommodations. Please be aware that accommodations cannot be enacted retroactively, making timeliness a critical aspect for their provision.

Diversity Statement: Students will have many opportunities to discuss ethical dimensions of data analytics and explore challenging issues. This course aims to increase understanding of different perspectives via structured and unstructured discussions and encourage students to provide constructive critical assessment and feedback on feedback. Such conversations may not always be easy and require trust, practice, patience, courage and imagination. The ground rule for the class is to have due regard for the feelings, wishes, rights, or traditions of others and to respect each other's' backgrounds, experiences, and positions, as we deepen our understandings of multiple perspectives striving to acquire, develop, and communicate research findings to the best of our knowledge.

Academic Conduct: Each student is responsible for upholding the highest standards of academic integrity, as specified in the [Friedman School's Policies and Procedures manual](#) and [Tufts University policies](#). It is the responsibility of each student to understand and comply with these standards, as violations will be sanctioned by penalties ranging from failure on an assignment to dismissal from the school.

Course Organization: This course will follow a hybrid design. Students are expected to watch asynchronous lectures and complete all readings before class. Online discussion posts and reading reflections should be submitted on Canvas prior to class. Class time (offered in-person and virtually, Mondays 4-6pm) will be used for synchronous discussion of lecture materials, class activities, and instructor feedback on previously submitted assignments. Students are also mandated to attend a practicum session (offered virtually only, Thursdays 4-5pm). Practicum sessions will include peer feedback on upcoming homework assignments and resource sharing for student's independent software programming learning. Office hours (offered virtually Thursdays 5-6pm; in-person by appointment only) are held directly after this practicum session. At the end of each week (Fridays), students will be asked to complete written assignments and submit these on Canvas.

The course is designed into a series of modules (14 total). Each week students are expected to spend ~6 hours on asynchronous instruction (readings, lectures, discussion posts, assignments, data management, statistical coding, data analysis, peer feedback) and ~3 hours on synchronous instruction (discussions, practicum, peer feedback). Time requirements will differ by week and by student (estimates provided below).

<i>Course Material</i>	<i>Estimated Time per Week</i>	<i>Description</i>
Readings and Reading Posts	85 Minutes	Students will be asked to complete 1-3 weekly readings and post a review about these readings on Canvas prior to arriving to Monday synchronous discussions.
Asynchronous Lectures	30 Minutes	Lectures will be pre-recorded for independent viewing and posted on Canvas. Students must watch lectures prior to arriving to Monday synchronous discussions.
Synchronous Discussions	120 Minutes	Synchronous discussion sessions will be held every Monday. Students must attend either in-person or virtually. These sessions will be used to: i) provide feedback on student homework assignment submissions; ii) clarify questions and key points of pre-recorded lectures; and iii) facilitate team-based exercises and activities. In-class students will partner by seating convenience while virtual students will be divided into Zoom breakout rooms.
Practicum	60 Minutes	Practicums are mandatory and held virtually for all students. These sessions will take place Thursdays after Monday's synchronous discussions but prior to Friday's written assignment submission. As such, practicums will be used for reviewing student questions about upcoming homework assignments, peer-to-peer feedback, and small group

		discussions. Students can solicit instructor during Office Hours, which will take place virtually after the Practicum.
Written Assignments	185 Minutes	Students will complete weekly written assignments by Friday of every week. Students will submit these assignments as Word document files on Canvas. Students will also paste answers as plain text to allow for peer feedback. Weekly assignments are designed to build off one another and culminate in the completion of midterm and semester-long research projects.
Peer Feedback	30 Minutes	Students will be assigned partners weekly based on similarities in project's subject area and statistical methods used. In Discussion posts, students will submit written assignments as plain text every Friday. Students are expected to provide peer comments on all partners' assignments using prompted questions before class the following Monday.
Away-From-Screen Time	30 Minutes	We have incorporated time for students to detach from online work. While not in front of a screen, students are expected to use this time to reflect on their research projects, course progress, and individual research goals. Your away-from-screen time should involve walking, yoga, biking, or any form of activity away from the computer!

Assessment and Grading: Please see the course grade assessment breakdown below.

Assessment	Grade Value	Description
Final Project	50%	Project topics should be unique and approved by the instructor(s). <i>The final report is expected to be a draft of a paper for a scientific journal.</i>
Midterm Presentation	30%	Progress made on the course project will be presented in class mid-semester. <i>This assignment will involve developing a data analysis plan that will be executed in the second half of the semester and submitted as part of the final project.</i>
Group Activities	20%	Students are expected to work in groups of three throughout the semester. <i>During class, students will participate in group activities as a PI, Collaborator, and Reviewer to provide self-assessment and peer-assessment of their course projects.</i>

Assignment Submission Instructions: All homework assignments are posted on Friday at least one week before submission. The following policies will be strictly enforced.

Submission Time*	Points Possible	Description
On-Time	90%	On-time submission is equivalent to 90% of available points. Additional 10% of points awarded for completion of Bonus Questions.
≤24 Hours Late	70%	Assignments received ≤24hrs after deadline will be

		penalized by a 20% grade reduction.
>25-48 Hours Late	50%	Assignments submitted 25-48hrs after the deadline will be penalized by a 50% grade reduction.
>48 Hours Late	0%	Late submission will not be accepted or graded if late more than 48 hours.

* Students who are unable to complete an assignment on time for any reason should notify the instructor(s) and teaching assistant(s) by email at least one week prior to the deadline explaining why the extension is needed.

Texts and Materials: All materials will be made available on the Tufts Canvas site. Brief descriptions of the material and submission pages are provided below.

Materials	Description and Location
Learning Objectives	Learning objectives are outlined for each week. These objectives reflect the aims and goals addressed in all synchronous and asynchronous materials for that module. These objectives and their corresponding materials and assignments are outlined for each week at Canvas > Modules .
Module Assignment	Students will complete a written assignment for each Module, which addresses the objectives for that week. Written assignment templates are posted to Canvas > Files > Assignments . Students should download and complete these templates each week. Written assignments should be submitted as Word documents by the time and day they are due to Canvas > Assignments > Written Assignments .
Peer Feedback	Students are required to provide peer feedback throughout the semester. Peer feedback will be submitted as comments to student module assignments. In addition to file submission, written assignments should be pasted as plain text to Canvas > Discussions . Students will be given a template with prompt questions for responding to their partners' entries.
Reading List	Readings selected by instructor(s) are posted to Canvas > Files > Readings . Additional resources are provided in asynchronous recorded lecture materials. Students are also recommended to review chapters from P. Huber "Data Analysis" Wiley (2011) for guidance throughout the course.
Reading Assignment	For each required reading, students will answer prompted discussion questions (see below). We ask students to copy this template and submit their responses to Canvas > Assignments > Reading Assignments : <ul style="list-style-type: none"> • Paper Title • Rate the relevance of the paper for your research (please bold one of the following 3 options): 0-low; 1-medium; 2-high • Rate your comprehension of this paper (please bold one of the following 3 options): 0-low; 1-medium; 2-high • State the time taken to complete the reading: XX minutes • Summarize the most valuable lesson from this reading (1-2 sentences): • Explain how this material applies to your own research (1-2 sentences):
Asynchronous Lecture	Students are expected to watch asynchronous pre-recorded lectures prior to Monday synchronous discussions. Lecture slides and recordings are posted to Canvas > Files > Lecture Recordings .

Away-From-Screen Time Reflection	Within pre-recorded lectures, students will be posed questions to consider during their personal reflection time. This should be done independently while disconnecting from computer-based activities. Please note – while some recordings might ask for students to submit responses, none are required.
Synchronous Discussions	All synchronous materials will be dedicated to in-class small group activities and student assignment instructor feedback. The instructor will add these slides to Canvas > Files > Class Slides prior to Monday classes.
In-Class Participation	Within each synchronous discussion, students will be asked to report group discussion notes, findings, and feedback in class. Instructors will try to provide an overview of these activities on Canvas prior to Monday classes. Instructors may ask you to report your feedback using online Google documents or spreadsheets outlined for each week at Canvas > Modules .
Practicum	Practicum synchronous discussions will be held virtually on Thursdays and will be dedicated to refining technical skills, addressing questions, and providing peer feedback. All resources and class slides will be posted to Canvas > Files > Practicum .
Practicum Participation	As with synchronous discussions, students will be asked to report group discussion notes, findings, and feedback during practicums. Instructors may ask you to report your feedback using online Google documents or spreadsheets outlined for each week at Canvas > Modules .

3D Role Play: As part of the course design, each student will be trained in the following three roles: Principal Investigator, Co-Principal Investigator, and Reviewer. To fulfill these roles, students will be divided into groups of 3 students to allow for peer review and feedback on students' works. Students will partake in each role for each homework assignment.

<i>Role</i>	<i>Assignment Expectation</i>
Principal Investigator (PI)	Students will create and execute their own data analysis plan. Weekly written assignments will assist in research ideation, management, and execution throughout the semester. We will solicit student barriers and challenges when completing every assignment and use responses to drive Monday synchronous discussions and Thursday practicums each week.
Co- Principal Investigator (Co-PI)	As a Co-PI, students are expected to review homework assignments pasted to Discussion boards on Canvas each Friday and provide feedback prior to Monday class. Co-PIs will comment on students' assignments addressing points of confusion, clarity, or comprehension using prompted questions.
Reviewer	As a Reviewer, students will comment on their Collaborators' homework assignment progress prior to submission on Fridays. This feedback will come during Practicum sessions and offer guidance and support to tackling challenges, solutions, and providing general feedback prior to Friday written assignment submissions.

Classroom Conduct: The content of the course is unique. The schedule is dense. Missing more than 1 class per semester usually results in substantial under-performance. Students are expected to attend each synchronous class.

Virtual class attendance and practicums will be held to the same standards as in-class participation. We expect students to devote their full attention to virtual discussions without distractions. Students are also expected to read all assigned materials and review all asynchronous lectures, recordings, and readings before arriving to class. We expect the following code of conduct for all virtual sessions:

<i>Activity/Event</i>	<i>Conduct</i>
Participating During Zoom	When speaking, please ensure your video is on and your audio is unmuted. When not speaking, keep your video on and mute your audio to minimize background noise. Zoom invitations are posted to Canvas > Zoom .
Time Zone Differences	Synchronous materials will be performed according to Eastern Standard Time (EST). Please notify instructors if you are residing in a different time zone. Accommodations will be made as needed.
Zoom Session Recordings	All Zoom sessions will be recorded and posted to Canvas > Zoom . If you do not wish to be recorded, you are permitted to leave your video off or change your name to hide your identity.
Poor Internet Connection	In the event of poor internet connection or power outage, please email the instructor and teaching assistants. Students are expected to call directly into Zoom using the phone-in number for the remainder of class.
In-Class Participation	For synchronous in-class discussions and virtual practicums, students are expected to equally distribute and rotate team tasks. These include: a timekeeper, a scribe for tracking student discussion points, and a reporter to present discussion points to the class.

Course Schedule: Subject to change at the instructor(s) discretion. Assignments are due by the end of the week they are assigned. Students are expected to download the assignment submission template and submit their completed template as a Word document on Canvas.

<i>Week of</i>	<i>Module</i>	<i>Assignment Description</i>
Sep. 06	0. Welcome. Introduction to SOLSTICE	Review our SOLSTICE Information website . Complete the IRB consent form and start-of-class questionnaire found here .
Sep. 13	1. Introduction to Advanced Data Analysis	Assignment 1 . Identify a GREAT dataset for the course project and describe it using a <i>data quality and integrity assessment</i> (DQIA).
Sep. 20	2. Research hypotheses formulation	Assignment 2 . Draft a Proposal Abstract for the course project (300-400 words). <i>Cite a minimum of 5 references in the abstract.</i>
Sep. 27	3. Research design for advanced data analysis	Assignment 3 . Formulate Specific Aims, Research Hypotheses, and Statistical Hypotheses. Revise Proposal Abstract to incorporate aims and hypotheses. <i>Instructor feedback given on this assignment.</i>
Oct. 04	4. Principles of advanced data analysis	Assignment 4 . Draft your research codebook using the Excel workbook template. Revise your DQIA.
Oct. 11	5. Statistical principles for assessing differences (No synchronous class)	Assignment 5 . Draft a data management and analysis plan. You must include data tables with preliminary results summaries. (Celebrate Indigenous Peoples' Day!)
Oct. 18	6. Statistical principles for	Assignment 6 . Draft a Conference Abstract (200-300 words; must

	assessing associations	include preliminary results). Identify a conference to submit abstract. <u>Midterm.</u> Submit 6 presentation slides and 3 minute recording based on Conference Abstract. (Due: Monday Oct. 25 at 12:00pm EST)
Oct. 25	7. Mid-term presentations* <i>This assignment is graded.</i>	<u>Assignment 7.</u> Draft the Data and Methods of the semester-long project manuscript using the Final Paper Template.
Nov. 01	8. Model building strategies for temporal analyses	<u>Assignment 8.</u> Draft the Introduction (1-2 pages) and preliminary figures and tables of the semester-long project manuscript.
Nov. 08	9. Model building strategies for spatiotemporal analyses	<u>Assignment 9.</u> Revise the Data and Methods based on reviewer comments. Draft Results and include summary tables and intermediate results. <i>Feedback given on this assignment.</i>
Nov. 15	10. Data visualization techniques	<u>Assignment 10.</u> Draft Discussion and Conclusion sections. Complete Results section. Revise Introduction section. Compile the semester-long project manuscript.
Nov 22	No class	Enjoy your Thanksgiving!
Nov. 29	Final Presentations 1* <i>This assignment is graded.</i>	<u>Final Presentations Round 1.</u> Submit final presentation draft. This includes 12 presentation slides and 5 minute recording. Use the Final Presentation Rubric. You may re-record for final submission.
Dec. 06	Final Presentations 2* <i>This assignment is graded.</i>	<u>Final Presentations Round 2.</u> Submit final presentation draft. This includes 12 presentation slides and 5 minute recording. Use the Final Presentation Rubric. You may re-record for final submission.
	<i>Assignments are graded.</i>	<u>Final Submission.</u> Final Manuscript, Final Presentation, and <u>SOLSTICE Exit Survey</u> (Due: Monday Dec. 13 at 11:59pm EST)

* Please note that Midterm and Final Presentation drafts are to be submitted before they are presented to allow enough time for Peer Review prior to in-class presentation.

Course Topics, Learning Objectives and Assignments – create modules to Canvas

* The schedule and material are subject to modification at the instructor's discretion.

MODULE 0: Welcome. Introduction to SOLSTICE.

<i>Activities</i>	<i>Description</i>	<i>Due Date</i>
Learning Objectives	1. Introduce teaching faculty and their professional experiences 2. Describe motivations for the course content and structure 3. Review NSF SOLSTICE grant aims and requirements	
<u>Asynchronous Lecture</u>	This course lecture will inform students of the motivations for the course content and structure, the NSF grant aims, and NSF grant requirements.	
Reading List	None	
Reading Assignment	Review our SOLSTICE Information website . Please email instructors and teaching assistants with any questions you have about SOLSTICE.	13 Sep. By 4:00pm EST
Module Assignment	Complete the IRB consent form and questionnaire on our SOLSTICE Entry Survey .	13 Sep. By 4:00pm EST
Peer Feedback	None	
Away-From-Screen Time Reflection	You will be required to use a dataset for your course project this semester. Begin identifying a dataset before arriving to class. You will have the 1 st week of classes to find a dataset when the semester starts. The dataset should be on a topic and within a discipline of interest and expertise to you. If you cannot find a dataset, please use this repository and/or email instructors and teaching assistants to discuss possible options.	
Synchronous Discussion	None	
In-Class Participation	None	
Practicum	None	
Practicum Participation	None	

MODULE 1: Introduction to Advanced Data Analysis.

<i>Activities</i>	<i>Description</i>	<i>Due Date</i>
Learning Objectives	<ol style="list-style-type: none"> 1. Define and explain the main concepts of Environmental, Health, and Nutrition Informatics. 2. Identify a GREAT dataset criteria for your semester long project. 3. Understand how to describe and explain attributes of a GREAT dataset when brainstorming a research project. 	
Asynchronous Lectures 1.1 , 1.2 , and 1.3	This course lecture will outline the course aims and structure with advice on how to read research articles with a purpose. Students will also be advised on how to choose GREAT datasets for use in research projects.	
Reading List	<ol style="list-style-type: none"> 1. Safran, C., Bloomrosen, M., Hammond, W. E., Labkoff, S., Markel-Fox, S., Tang, P. C., & Detmer, D. E. (2007). Toward a national framework for the secondary use of health data: an American Medical Informatics Association White Paper. <i>Journal of the American Medical Informatics Association</i>, 14(1), 1-9 2. Soskolne CL, Kramer S, Ramos-Bonilla JP, Mandrioli D, Sass J, Gochfeld M, Cranor CF, Advani S, Bero LA. Toolkit for detecting misused epidemiological methods. <i>Environmental Health</i>. 2021 Dec;20(1):1-6. 	
Reading Assignment	Reading 1. Please rate all assigned readings according to the template provided in the <i>Texts and Materials</i> section outlined above.	13 Sep. By 4:00pm EST
Module Assignment	Assignment 1. Identify a GREAT dataset for the course project and describe it using a <i>data quality and integrity assessment</i> (DQIA).	17 Sep. By 11:59pm EST
Peer Feedback	Feedback 1. Please post selective homework questions as free text to the Discussion board. Answer prompted questions for all <u>your partners</u> .	20 Sep. By 4:00pm EST
Away-From-Screen Time Reflection	Begin thinking about a dataset that you intend to analyze throughout the semester. Reflect on how complicated your data are and what you need to do to examine them.	
Synchronous Discussion	<ol style="list-style-type: none"> 1. Identify disciplinary interests, technical or management skills, and personality traits important for data analytics 2. Define the following terms: Science, Discipline, Data, Information, Knowledge, Model 3. Define the hierarchy and interconnections between terms 	
In-Class Participation	Report 2-3 keywords or phrases summarizing your disciplinary interests, skills, and personality traits. Report the definition of your assigned term in your own words. Report the expected relationships between terms. The Google document for reporting your answers can be found here: xxx	13 Sep. 5:00-6:00pm EST
Practicum	<ol style="list-style-type: none"> 1. Discuss the advantages and limitations of project-based learning 2. Begin brainstorming research questions and gaps in knowledge that you can address using your GREAT dataset 	
Practicum Participation	Report 2-3 advantages and limitations for each element of project-based learning. Informally discuss project goals, topic areas of interest, and the research questions that can be addressed with your dataset. The Google document for reporting your answers can be found here: xxx	16 Sep. 4:00-5:00pm EST

MODULE 2: Research hypotheses formulation.

Activities	Description	Due Date
Learning Objectives	<ol style="list-style-type: none"> 1. Understand how to formulate basic research hypotheses 2. Practice justifying hypotheses with proper evidence 3. Understand the main concepts of research design 	
Asynchronous Lectures 2.1 and 2.2	This course lecture will guide students in defining disciplinary perspectives, recognizing knowledge gaps, creating research hypotheses to address these gaps, and provided proper evidence to support hypotheses.	
Reading List	Breiman, L. (2003). Statistical modeling: The two cultures. <i>Quality control and applied statistics</i> , 48(1), 81-82.	
Reading Assignment	Reading 2. Please rate all assigned readings according to the template provided in the <i>Texts and Materials</i> section outlined above.	20 Sep. By 4:00pm EST
Module Assignment	Assignment 2. Draft a Proposal Abstract for the course project (300-400 words). Cite a minimum of 5 references in the abstract.	24 Sep. By 11:59pm EST
Peer Feedback	Feedback 2. Please post selective homework questions as free text to the Discussion board. Answer prompted questions for all your partners.	27 Sep. By 4:00pm EST
Away-From-Screen Time Reflection	Reflect on how you can add complexity to your research statement. Can you re-state your research hypothesis using the term <u>compare</u> across groups and over time to reflect problem complexity?	
Synchronous Discussion	<ol style="list-style-type: none"> 1. Discussing rules of providing public critique 2. Describing your dataset, data source, research problem, and knowledge gap to partners for peer feedback 3. Define knowledge gaps and research questions that can be addressed using your dataset and methods on how to address them 	
In-Class Participation	Report on the data source, knowledge gap, and research problem of team members. State the peer feedback received and research questions brainstormed within your group. The Google document for reporting your answers can be found here: xxx	20 Sep. 5:00-6:00pm EST
Practicum	<ol style="list-style-type: none"> 1. Discussing roles within a research team: Principal Investigator, Collaborator, and Reviewer 2. Self-assessment of strengths and weaknesses when conducting research with respect to knowledge, skills, and personality traits 3. Peer discussion on techniques for integrating strengths with class activities or overcoming weaknesses throughout the course 	
Practicum Participation	Discuss and report in-depth team introductions based on self-assessments. Comment on how students' datasets and research questions for the semester long project align with their course objectives and personal goals. The Google document for reporting your answers can be found here: xxx	23 Sep. 4:00-5:00pm EST

MODULE 3: Research design for advanced data analysis.

<i>Activities</i>	<i>Description</i>	<i>Due Date</i>
Learning Objectives	<ol style="list-style-type: none"> Understand the main concepts of the scientific method Understand common mistakes in applying the scientific method Understanding how to critically review hypotheses and evidence 	
Asynchronous Lectures 3.1 and 3.2	This course lecture will guide students through detecting common mistakes in research hypotheses, aligning data-supported evidence and hypothesis generation, and the research design in preparation for data analysis	
Reading List	<ol style="list-style-type: none"> Coper, H. (2009). Hypotheses and problems in research synthesis. In & J. C. V. H. Cooper, L. V. Hedges (Ed.), <i>The Handbook of Research Synthesis and Meta-Analysis</i> (2nd ed., pp. 19–35). New York: Russell Sage Foundation. Kell, D. B., & Oliver, S. G. (2003). Here is the evidence, now what is the hypothesis? The complementary roles of inductive and hypothesis-driven science in the post-genomic era. <i>BioEssays</i>, 26, 99–105. https://doi.org/10.1002/bies.10385 	
Reading Assignment	Reading 3. Please rate all assigned readings according to the template provided in the <i>Texts and Materials</i> section outlined above.	27 Sep. By 4:00pm EST
Module Assignment	Assignment 3. Formulate Specific Aims, Research Hypotheses, and Statistical Hypotheses. Revise Proposal Abstract to incorporate aims and hypotheses. <i>Instructor feedback given on this assignment.</i>	01 Oct. By 11:59pm EST
Peer Feedback	Feedback 3. Please post selective homework questions as free text to the Discussion board. Answer prompted questions for all your partners .	04 Oct. By 4:00pm EST
Away-From-Screen Time Reflection	Reflect on how you can add complexity to your research statement by considering time and space dimensions. Reflect on how a system or a question under the study could be expanded to include real-life scenarios	
Synchronous Discussion	<ol style="list-style-type: none"> Defining linkages between data used and models specified Defining linkages between questions/hypotheses asked and the supporting evidence available to justify those hypotheses Defending student research knowledge gap, aims, and hypotheses 	
In-Class Participation	Report student group discussion on the confidence in their data source, knowledge gap, and research problem for completing the course project. Report on challenges students face in defining and linking knowledge gaps, research aims, and research hypotheses. The Google document for reporting your answers can be found here: xxx	27 Sep. 5:00-6:00pm EST
Practicum	<ol style="list-style-type: none"> Review drafts of student abstracts in your research group Discuss challenges in defining the significance, knowledge gap, research question, study design, and anticipated results of abstract Feedback recipients provide feedback on the quality of peer feedback 	
Practicum Participation	Discuss and report the greatest challenges and rewards of giving and receiving feedback and feedback-on-feedback. Discuss challenges faced in completing a proposal abstract with targeted knowledge gaps, aims, and research hypotheses. The Google document for reporting your answers can be found here: xxx	30 Sep. 4:00-5:00pm EST

MODULE 4: Principles of advanced data analysis.

<i>Activities</i>	<i>Description</i>	<i>Due Date</i>
Learning Objectives	1. Understanding how to build a sequence of research hypotheses 2. Recognizing data limitations relevant to a research question 3. Converting research questions and hypotheses into analytical tasks	
Asynchronous Lectures 4.1 and 4.2	This course lecture will instruct students on how to build a sequence of research hypotheses, understand principles guiding the research and data analysis process, and breakdown linkages between research problem statements, goals, specific aims, research hypotheses, and statistical hypotheses.	
Reading List	1. Victora, C. G., Huttly, S. R., Fuchs, S. C., & Olinto, M. T. (1997). The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. <i>International journal of epidemiology</i> , 26(1), 224-227. 2. Grimes, D. A., & Schulz, K. F. (2002). Cohort studies: marching towards outcomes. <i>Lancet</i> , 359, 341–45.	
Reading Assignment	Reading 4. Please rate all assigned readings according to the template provided in the <i>Texts and Materials</i> section outlined above.	04 Oct. By 4:00pm EST
Module Assignment	Assignment 4. Draft your research codebook using the Excel workbook template. Revise your DQIA.	08 Oct. By 11:59pm EST
Peer Feedback	Feedback 4. Please post selective homework questions as free text to the Discussion board. Answer prompted questions for all <u>your partners</u> .	11 Oct. By 4:00pm EST
Away-From-Screen Time Reflection	Reflect on potential pitfalls and limitations posed by your data and study design.	
Synchronous Discussion	1. Understanding the alignment of principles of data analysis and Bloom's taxonomy for effective communication 2. Refine ability to articulate linkages in research objectives from knowledge gap to specific aim to research and statistical hypotheses	
In-Class Participation	Discuss the linkages between research problem statements, knowledge gaps, study goals, specific aims, research hypotheses, and study design/statistical hypotheses. Rate your clarity on the linkages of these elements. The Google document for reporting your answers can be found here: xxx	04 Oct. 5:00-6:00pm EST
Practicum	This session will be a working session for students to complete their data codebooks and update data quality and integrity assessments in the company of their peers, TAs, and instructor. Breakout rooms are available to answer student-specific questions as needed.	
Practicum Participation	Students are expected to attend the Practicum session and come with questions. No formal reporting will be required for this week.	07 Oct. 4:00-5:00pm EST

MODULE 5: Statistical principles for assessing differences.

<i>Activities</i>	<i>Description</i>	<i>Due Date</i>
Learning Objectives	<ol style="list-style-type: none"> 1. Understanding the elements of a data analysis plan, specifically the tasks needed including conceptual mapping and statistical hypothesis formation 2. Review statistical principles for assessment of differences 3. Refine understanding of data limitation related to research questions and analytical tasks needed for answering research questions and hypotheses 	
Asynchronous Lectures 5.1 and 5.2	This course lecture will describe the steps for drafting a data management plan, articulating principles of data analysis for your research process, and performing statistical tests and techniques for analyzing statistical hypotheses.	
Reading List	Naumova EN, Must A, Laird NM. Evaluating the impact of “critical periods” in longitudinal studies of growth using the piecewise mixed effects models. International Journal of Epidemiology. 2001, 30 (6): 1332-41.	
Reading Assignment	Reading 5. Please rate all assigned readings according to the template provided in the <i>Texts and Materials</i> section outlined above.	11 Oct. By 4:00pm EST
Module Assignment	Assignment 5. Draft a data management and analysis plan. You must include data tables with preliminary results summaries.	15 Oct. By 11:59pm EST
Peer Feedback	Feedback 5. Please post selective homework questions as free text to the Discussion board. Answer prompted questions for all <u>your partners</u> .	18 Oct. By 4:00pm EST
Away-From-Screen Time Reflection	Reflect on how you progress from a simple description of your data toward hypothesis testing tasks. Which tasks are straightforward, and which require more work?	
Synchronous Discussion	None. Celebrate Indigenous People’s Day!	
In-Class Participation	None. Celebrate Indigenous People’s Day!	
Practicum	In this session, you will complete a Mistake Finding Exercise meant to challenges students in identifying the methods and applications of methods used in published research.	
Practicum Participation	Each group will have its own Mistake Finding Exercise worksheet. Report your group’s mistakes in its respective Google document. Have your document handy when reporting back to the group session. The Google document for reporting your answers can be found here: xxx	14 Oct. 4:00-5:00pm

MODULE 6: Statistical principles for assessing association.

Activities	Description	Due Date
Learning Objectives	<ol style="list-style-type: none"> 1. Perform and interpret statistical tests and techniques 2. Understand effects of outliers, misspecification, detection limits, and non-random missingness 3. Select relevant measures of association (parametric and nonparametric) between two random variables 	
Asynchronous Lectures 6.1 , 6.2 , and 6.3	This course lecture will discuss statistical principles for the assessment of association including both parametric and non-parametric comparisons. The lecture then describes deviations from standard statistical output that require further manipulation, exploration, and sub-analysis during the research process.	
Reading List	Hadi, A. S., Imon, A. R., & Werner, M. (2009). Detection of outliers. Wiley Interdisciplinary Reviews: Computational Statistics, 1(1), 57-70	
Reading Assignment	<p>Reading 6. Please rate all assigned readings according to the template provided in the <i>Texts and Materials</i> section outlined above.</p>	18 Oct. By 4:00pm EST
Module Assignment	<p>Assignment 6. Draft a Conference Abstract (200-300 words; must include preliminary results). Identify a conference to submit abstract.</p> <p>Midterm. Submit 6 presentation slides and 3 minute recording based on Conference Abstract. (Due: Monday Oct. 25 at 12:00pm EST)</p>	22 Oct. By 11:59pm EST 25 Oct. By 12:00pm EST
Peer Feedback	<p>Feedback 6. Review your partners' Conference Abstracts. Come ready with questions and comments for reviewing Midterm Presentations. <u>No comments are to be posted for this week.</u></p>	25 Oct. By 4:00pm EST
Away-From-Screen Time Reflection	Think about an example from your personal experience that might constitute a positive deviance example.	
Synchronous Discussion	<ol style="list-style-type: none"> 1. Review challenges/barriers when developing analytical plans and attempted solutions for these challenges 2. Brainstorming with peers' solutions to overcome challenges and pitfalls within the data management and analytical plan 	
In-Class Participation	<p>Report challenges, barriers, and limitations when developing analysis plans. Identify attempted solutions and discuss future efforts. Report findings to class and discuss in further detail with instructors. The Google document for reporting your answers can be found here: xxx</p>	18 Oct. 5:00-6:00pm EST
Practicum	Practice giving your Midterm Presentation live to your peers. Alternatively, present as much of your presentation as you have and your plans for how to complete. Solicit feedback from team members.	
Practicum Participation	<p>Students will use this time to practice midterm presentations and solicit peer feedback. Practice presenting in 3 minutes with or without slides (depending on what you have completed thus far). Peers provide 3 minutes of feedback. Rotate until all partners have presented and report challenges to the class. The Google document for reporting your answers can be found here: xxx</p>	21 Oct. 4:00-5:00pm EST

Midterm Presentations

Learning Objectives

-
- 1) Practice the basics of scientific communication, including content and delivery.
 - 2) Create effective elements of research presentation including tables, graphs, and other visuals based on three principles of graphical presentation (evidence, efficiency, and emphasis).
 - 3) Critique elements of presentations: data sources, sample selection, measures of outcomes, measures of exposures, adequacy of analysis, possible effects of bias, interpretation of results.

Dates and Deadlines

Due to the size of the class, presentations will take place in 2 rounds. The first round will have recordings shown and defenses given on Monday 25 Oct. 2021. The second round will have recordings shown and defenses given on Thursday 28 Oct. 2021.

Assignment Instructions

- 1) **All presentations must be submitted by 12:00pm on 25 OCT. 2021.**

Late submissions will not be accepted. Please save and submit your Midterm Presentation using the following file name: lastname_firstname_ADA_Midterm.

- 2) **Please upload your midterm presentation on Canvas. Be sure to include:**

- a. MP4/MOV recording of your presentation;
- b. PowerPoint/PDF file of the slides used throughout the presentation.

Presentations will be 3 minutes maximum (time limit strictly enforced) and no more than 6 slides (animations are permitted and encouraged). Going over the time limit will result in point deduction. Student presentations will be shown in class on 25 Oct. 2021.

- 3) **After recordings are shown in class, students are expected to:**

- a. **Use 2 minutes to defend their research.** This includes further justification of the methods used to answer your research questions as well as any modifications you have to your study design after reflecting on your recording.
- b. **Spend 3 minutes answering questions from group partners and instructors.** Partners are expected to prepare questions prior to class. Questions should ask for further clarification of the study design or future research plans.

A successful presentation will pull elements from the Conference Abstract with a focus on the linkage between goals, problem statements, specific aims, research hypotheses, etc. Please structure your presentations using the rubric provided below. This rubric also provides questions for group partners to consider asking after in-class recordings are presented.

- 4) **All students will submit peer feedback on every student presentation using a Qualtrics survey during in-class student presentations.**

Students are responsible for providing 2-3 minutes of comments/questions after partners' presentation recordings are played in class. These comments will be in addition to providing a survey response for each student. Instructors will judge the quality of your feedback. We expect thoughtful, concise, and specific comments on the study design, methods, and presentation style of your group partners.

Assessment Rubric

Slide	Content Included	Score	Out Of
1	<i>Introductory Slide (~15 Seconds)</i>		
	• Name and Tufts University academic concentration		2
	• Preliminary working title		2
2	<i>Introduction and Background (~30 Seconds)</i>		
	• Basic introduction of the topic		6
	• More detailed background of discipline		4
3	<i>Research Problem and Goal (~30 Seconds)</i>		
	• Problem statement for why research is needed in this area		6
	• Overarching goal of your research		8
	• Specific aims for how this goal will be analyzed		8
	• Research hypothesis for evaluating each goal		8
4	<i>Methodology & Modeling (~60 Seconds)</i>		
	• What statistical models will you use to analyze your specific aims?		8
	• What key dependent and independent variables will you use?		6
	• Provide one preliminary model in correct notation		4
5	<i>Preliminary Results (~30 Seconds)</i>		
	• What interesting results have you found so far?		6
	• Why are these results important to answer your research question?		6
	• Please frame these results in a more general context		4
6	<i>Future Directions (~15 Seconds)</i>		
	• How do preliminary results influence next steps in your research?		6
	• What difficulties do you expect moving forward?		6
	<i>Overall Presentation</i>		
	• Clarity		5
	• Comprehension/Cohesiveness		5
	MIDTERM PRESENTATION FINAL SCORE		100

Peer Feedback Questions to Consider

- Does background information articulate why additional research is necessary?
- What is the knowledge gap being addressed? How will this be addressed by the study?
- What are the underlying goals of the study? Do specific aims address these goals clearly?
- Do preliminary results properly state uncertainty (i.e., p-values, confidence intervals, etc.)?
- Do results provide a magnitude, direction, and significance that describes, explains, or predicts an association between exposure and outcome?

Common Barriers and Challenges

- Lack of stating the importance and/or timeliness of the problem
- Lack of stating gaps in knowledge
- Lack of stating the direction of association in the research hypothesis statement
- Ambiguity in defining key concepts, terms, variables, or model components
- Lack of stating the direction of association in presenting the results
- Lack of support for stated results

MODULE 7: Midterm Presentations (In-Class Defense)

<i>Activities</i>	<i>Description</i>	<i>Due Date</i>
Learning Objectives	<ol style="list-style-type: none"> 1. Practice the basics of scientific communication, including content and delivery. 2. Create effective elements of research presentation including tables, graphs, and other visuals based on three principles of graphical presentation (evidence, efficiency, and emphasis). 3. Critique elements of presentations: data sources, sample selection, measures of outcomes, measures of exposures, adequacy of analysis, possible effects of bias, interpretation of results. 	
Asynchronous Lecture	None	
Reading List	<ol style="list-style-type: none"> 1. How to prepare your elevator pitch 2. Author guidelines for displaying data 3. Exploratory data analyses and graphic displays 4. Visualizations in scientific texts 	
Reading Assignment	Reading 7. <u>No formal posts are required for this week. Instead, we have provided resources to assist in your Midterm presentation defense.</u>	25 Oct. By 4:00pm EST
Module Assignment	Assignment 7. Draft the Data and Methods of the semester-long project manuscript using the Final Paper Template.	29 Oct. By 11:59pm EST
Peer Feedback	Feedback 7. Please post selective homework questions as free text to the Discussion board. Answer prompted questions for all <u>your partners</u> .	01 Nov. By 4:00pm EST
Away-From-Screen Time Reflection	None	
Synchronous Discussion	Midterm presentations	
In-Class Participation	Required midterm presentation peer feedback. <u>Please use this Qualtrics survey.</u>	01 Nov. 5:00-6:00pm EST
Practicum	Midterm presentations	
Practicum Participation	Required midterm presentation peer feedback. <u>Please use this Qualtrics survey.</u>	28 Oct. 4:00-5:00pm EST

MODULE 8: Model building strategies for temporal analyses.

Activities	Description	Due Date
Learning Objectives	<ol style="list-style-type: none"> 1. Articulate underlying principles of temporal patterns 2. Perform statistical tests and build statistical models for analyzing time series data 3. Visualize temporal relationships and patterns 	
Asynchronous Lectures 8.1 and 8.2	This course lecture will discuss statistical principles for conducting time series analyses. This includes model specification for basic temporal trends and a brief overview of how to assess and visualize seasonal patterns.	
Reading List	R.H. Shunway and D.S. Stoffer, Time Series Analysis and Its Applications: With R Examples, Springer Texts in Statistics. 2011.	
Reading Assignment	Reading 8. Please rate all assigned readings according to the template provided in the <i>Texts and Materials</i> section outlined above.	01 Nov. By 4:00pm EST
Module Assignment	Assignment 8. Draft the Introduction (1-2 pages) and preliminary figures and tables of the semester-long project manuscript.	05 Nov. By 11:59pm EST
Peer Feedback	Feedback 8. Please post selective homework questions as free text to the Discussion board. Answer prompted questions for all your partners .	08 Nov. By 4:00pm EST
Away-From-Screen Time Reflection	Reflect on how you might include time series analyses in your research. What types of comparisons could be evaluated if temporal data were available?	
Synchronous Discussion	<ol style="list-style-type: none"> 1. Reflect on the midterm presentations and midterm defense process 2. Complete a Mistake Finding Exercise meant to challenges students in identifying the methods and applications of time series analyses 	
In-Class Participation	Each group will have its own Mistake Finding Exercise worksheet. Report your group's mistakes in its respective Google document. Have your document handy when reporting back to the group session. The Google document for reporting your answers can be found here: xxx	01 Nov. 5:00-6:00pm EST
Practicum	<ol style="list-style-type: none"> 1. Discuss differences between collinearity and interaction when evaluating the results of regression models 2. Complete an in-class exercise to evaluate model graphics and regression output to determine if collinearity and/or interaction exist 	
Practicum Participation	Discuss differences in collinearity and interaction. Report which scenario your groups' model graphics and output reflect. Discuss applications of these analyses in student projects. The Google document for reporting your answers can be found here: xxx	04 Nov. 4:00-5:00pm EST

MODULE 9: Model building strategies for spatiotemporal analyses.

Activities	Description	Due Date
Learning Objectives	<ol style="list-style-type: none"> 1. Articulate underlying principles of spatiotemporal patterns 2. Perform statistical tests and build statistical models for analyzing data collected over both space and time 3. Visualize spatiotemporal relationships and patterns using an example of student research 	
Asynchronous Lectures 9.1 and 9.2	This course lecture will discuss statistical principles for conducting spatiotemporal analyses. This includes model specification for basic spatiotemporal trends and how to assess and visualize these trends.	
Reading List	Adrienko, N. & Adrienko, G. (2006). Exploratory Analysis of Spatial and Temporal Data - A Systematic Approach. Chapter 1: Introduction	
Reading Assignment	Reading 9. Please rate all assigned readings according to the template provided in the <i>Texts and Materials</i> section outlined above.	08 Nov. By 4:00pm EST
Module Assignment	Assignment 9. Revise the Data and Methods based on reviewer comments. Draft Results and include summary tables and intermediate results. Feedback given on this assignment.	12 Nov. By 11:59pm EST
Peer Feedback	Feedback 9. Please post selective homework questions as free text to the Discussion board. Answer prompted questions for all your partners .	15 Nov. By 4:00pm EST
Away-From-Screen Time Reflection	Reflect on how you might include analysis of spatiotemporal data in your research (not necessarily for this course, but in your research in general). What types of comparisons could be evaluated if data that include both spatial and temporal components were available?	
Synchronous Discussion	<ol style="list-style-type: none"> 1. Reflect on the spatial and temporal components of student datasets 2. Evaluate how data can be aggregated to different temporal and spatial scales within your analysis 	
In-Class Participation	Report the spatial and temporal components of your dataset. Describe their importance in the context of the generalizability and reproducibility of your research. Report team discussions in class. The Google document for reporting your answers can be found here: xxx	08 Nov. 5:00-6:00pm EST
Practicum	<ol style="list-style-type: none"> 1. Complete a Mistake Finding Exercise meant to challenges students in identifying the methods and applications of spatiotemporal analyses 2. Describe the strengths and weaknesses of the methods used and approaches to make data more presentable 	
Practicum Participation	Each group will have its own Mistake Finding Exercise worksheet. Report your group's mistakes in its respective Google document. Have your document handy when reporting back to the group session. The Google document for reporting your answers can be found here: xxx	11 Nov. 4:00-5:00pm EST

MODULE 10: Data visualization techniques.

<i>Activities</i>	<i>Description</i>	<i>Due Date</i>
Learning Objectives	<ol style="list-style-type: none"> 1. Review key principles for performing statistical modeling and specifying parameters within statistical models 2. Review modeling diagnostic tools to assess model performance 3. Discuss important concepts related to visualizing complex data, data ethics, perception of research findings, and statistical significance 	
Asynchronous Lectures 10.1 and 10.2	This course lecture will serve as the conclusion to the semester. It will provide a glimpse into topic areas important for data analysis that students should continue to pursue while also summarizing the data analytics foundation they have created this semester.	
Reading List	Michel, M. C., Murphy, T. J., & Motulsky, H. J. (2020). New author guidelines for displaying data and reporting data analysis and statistical methods in experimental biology. <i>Drug Metabolism and Disposition</i> , 48(1), 64-74.	
Reading Assignment	Reading 10. Please rate all assigned readings according to the template provided in the <i>Texts and Materials</i> section outlined above.	15 Nov. By 4:00pm EST
Module Assignment	Assignment 10. Draft Discussion and Conclusion sections. Complete Results section. Revise Introduction section. Compile the semester-long project manuscript.	19 Nov. By 11:59pm EST
Peer Feedback	Feedback 10. Please post selective homework questions as free text to the Discussion board. Answer prompted questions for all your partners.	22 Nov. By 4:00pm EST
Away-From-Screen Time Reflection	Reflect on the tasks you have completed this semester and their potential implication in your future work and professional career	
Synchronous Discussion	<ol style="list-style-type: none"> 1. Review the IADAR data analysis plan 2. Identify components that relate to the works completed by you in this course and those topics not covered. 	
In-Class Participation	Report on the topics covered by you and your team within the course. Discuss topics that you did not cover in the course or wish to have spent more time covering. The Google document for reporting your answers can be found here: xxx	15 Nov. 5:00-6:00pm EST
Practicum	<ol style="list-style-type: none"> 1. Prepare and present a manuscript illustration (table or figure) that will be submitted in your final paper 2. Describe the strengths and weaknesses of the visual and solicit feedback from your partners on how to improve the visual 	
Practicum Participation	Report the challenges faced when creating the visuals presented in your group. Discuss solutions you proposed to improve the clarity and comprehension of data and information within each visual. The Google document for reporting your answers can be found here: xxx	18 Nov. 4:00-5:00pm EST

Thanksgiving Break

Class will not meet on 22 Nov. 2021 or 25 Nov. 2021 due to the Thanksgiving holiday.

Final Presentation Round 1 must be submitted to Canvas by 11:59pm EST on 26 Nov. 2021.

Final Presentations

Learning Objectives

- 1) Practice the basics of scientific communication, including content and delivery.
- 2) Create effective elements of research presentation including tables, graphs, and other visuals based on three principles of graphical presentation (evidence, efficiency, and emphasis).
- 3) Critique elements of presentations: data sources, sample selection, measures of outcomes, measures of exposures, adequacy of analysis, possible effects of bias, interpretation of results.

Dates and Deadlines

Due to the size of the class, presentations will take place in 2 rounds. All students, irrespective of round, will be graded to the same standard.

Final Presentations Round 1

Submission Deadline: 11:59pm 26 Nov. 2021
In-Class Defense: 4:00pm 29 Nov. 2021

Final Presentations Round 2

Submission Deadline: 11:59pm 03 Dec. 2021
In-Class Defense: 4:00pm 06 Dec. 2021

Late submissions will not be accepted. Please save and submit your Midterm Presentation using the following file name: lastname_firstname_ADA_Midterm.

Assignment Instructions

1) Please upload your midterm presentation on Canvas. Be sure to include:

- a. MP4/MOV recording of your presentation;
- b. PowerPoint/PDF file of the slides used throughout the presentation.

Presentations will be 5 minutes maximum (time limit strictly enforced) and no more than 12 slides. Specific slide requirements are provided on the rubric below. You have little time – focus your attention on Methods, Results, and Discussions. Be clear, comprehensive, and cohesive in your presentation. Student presentations will be shown in class.

2) After recordings are shown in class, students are expected to:

- a. **Use 2 minutes to defend their research.** This includes further justification of the methods used to answer your research questions as well as any modifications you have to your study design after reflecting on your recording.
- b. **Spend 3 minutes answering questions from group partners and instructors.** Partners are expected to prepare questions prior to class. Questions should ask for further clarification of the study design or future research plans.

A successful presentation will pull elements from the Final Paper abstract and summarizes your research. Your focus should be on the linkage between your specific aims/research hypotheses, methodologies to evaluate these hypotheses, and the preliminary/final results you have for your study.

3) All students will submit peer feedback on every student presentation using a [Qualtrics survey](#) during in-class student presentations.

Students are responsible for providing 2-3 minutes of comments/questions after partners' presentation recordings are played in class. These comments will be in addition to providing a survey response for each student. Instructors will judge the quality of your feedback. We expect thoughtful, concise, and specific comments on the study design, methods, and presentation style of your group partners.

Assessment Rubric

Slide	Content Included	Score	Out Of
1	<i>Introductory Slide (~15 Seconds)</i>		
	<ul style="list-style-type: none"> • Name and Tufts University academic concentration and interests, reviewer introduction 		1
	<ul style="list-style-type: none"> • Title, major academic disciplines 		1
2	<i>Introduction and Background (~45 Seconds)</i>		
	<ul style="list-style-type: none"> • Detailed background of discipline 		2
	<ul style="list-style-type: none"> • Footnotes at bottom of slide for cited works 		1
3-4	<i>Research Problem and Goal (~45 Seconds)</i>		
	<ul style="list-style-type: none"> • Problem statement for why research is needed in this area 		3
	<ul style="list-style-type: none"> • Overarching goal(s) 		3
	<ul style="list-style-type: none"> • Brief statement of specific aims for evaluating each goal 		3
5-7	<i>Methodology & Modeling (~60 Seconds)</i>		
	<ul style="list-style-type: none"> • Conceptual maps, perspectives, language, and terminology of methodological and analytical problems associated with research 		6
	<ul style="list-style-type: none"> • Description of methods/models to achieve specific aims 		8
	<ul style="list-style-type: none"> • Example of model in correct notation 		6
	<ul style="list-style-type: none"> • Justifications for how/why model selected/specified 		6
8-10	<i>Results (~90 Seconds)</i>		
	<ul style="list-style-type: none"> • Presenting of major results and their interpretation 		8
	<ul style="list-style-type: none"> • Presenting of minor results and their interpretation 		6
	<ul style="list-style-type: none"> • Discussion of model assessment/diagnostics 		6
11-12	<i>Discussion (~90 Seconds)</i>		
	<ul style="list-style-type: none"> • Impact of results with respect to knowledge gap 		8
	<ul style="list-style-type: none"> • Unexpected results and possible reasoning 		6
	<ul style="list-style-type: none"> • Challenges and limitations of presented solutions 		6
13-14	<i>Future Directions (~15 Seconds)</i>		
	<ul style="list-style-type: none"> • Ideas to move forward / future research 		3
	<ul style="list-style-type: none"> • Specific actions to be taken from research results 		3
	<ul style="list-style-type: none"> • Benefits and challenges of teamwork and collaboration 		2
	<i>Overall Presentation</i>		
	<ul style="list-style-type: none"> • Clarity/Comprehension/Cohesiveness 		2
	<ul style="list-style-type: none"> • Evidence of giving and receiving constructive feedback 		2
	<ul style="list-style-type: none"> • Evidence of responding clearly to comments and questions 		2
	<ul style="list-style-type: none"> • Evidence of applying classroom learning in own project 		2
	<ul style="list-style-type: none"> • Evidence of producing high-quality tables, graphs, and visuals 		2
	<ul style="list-style-type: none"> • Evidence of interdisciplinary collaboration by interacting effectively with team members from other disciplines 		2
	END-OF-TERM PRESENTATION FINAL SCORE		100

Peer Feedback Questions to Consider

- What is the knowledge gap being addressed? How will this problem statement be addressed during the study?
- Are methods presented in a logical order that follows a clear structure in the order they were likely conducted to perform the study?
- How did authors estimate the key exposure or exposures of interest? Do they articulate the magnitude and direction of outcomes and the magnitude and direction of potential biases?
- Do results serve a purpose and highlight an underlying message of the study? Does each result have a clear connection to the aim or objective it was meant to describe?
- Do the authors answer on the main contributions their research offers to the discipline or knowledge gap stated at the beginning of the manuscript?
- Do authors provide a general sense of future research directions or next steps that would be taken to expand upon the present study?

Common Barriers and Challenges

- Lack of stating the importance and/or timeliness of the problem
- Lack of stating gaps in knowledge
- Lack of stating the direction of association in the research hypothesis statement
- Ambiguity in defining key concepts, terms, variables, or model components
- Lack of stating the direction of association in presenting the results
- Lack of support for stated results
- Disconnect between methods and results
- Unclear ordering of methods, results, and discussion elements
- Ineffective use of data visualizations to convey key findings
- Failure to include study limitation and future directions for research
- Failure to include a conclusion section

Final Project Submission

The following components are required for complete submission of your Final Project:

1) Final Paper - the final manuscript should be completed using the Final Paper Template provided here: [ADA-CEE_PaperTemplate.docx](#). Manuscripts should include:

- Manuscript file saved and submitted as a Word document (no PDFs - instructors cannot provide comments easily);
- Revised tables and figures inserted within the text after first mentioning in the manuscript;
- Additional files with supplemental materials (all supplemental tables and figures must be mentioned in manuscript text);
- Properly formatted in-text citations and references in accordance with template guide; and
- Any modifications to the paper template deemed necessary according to your research project (do not modify template formatting).

2) Final Presentation - your final presentation should be submitted in accordance with the end-of-term rubric reported here: [ADA_EndtermRubric.docx](#). Presentations should include:

- Presentations saved and submitted as MP4 or MOV file types;
- Presentation slides saved and submitted as Powerpoint or PDF file types;
- Note that final presentations can be modified since their first showing in-class. We highly encourage you to modify your final presentation based on comments and feedback from your peers and instructors.

3) Presentation Feedback - you are responsible for providing feedback on your [group partners'](#) final presentations. This should include:

- Providing feedback and discussing challenges with partners during Practicum discussion sessions;
- Providing 1-2 minutes of comments and questions after in-class final presentations;
- Submitting a Qualtrics survey response for all students during the playing of final presentation recordings in class.
- We expect thoughtful, concise, and specific feedback on the study design, methods, results, and presentation style.

4) SOLSTICE Exit Survey - students are required to complete the [SOLSTICE exit survey](#).

- Responses monitor your knowledge, skills, and attitudes towards statistics and data sciences.
- We highly encourage all students to consent in the study.
- Even if not consenting, honest and anonymous survey responses help gauge retention of course materials from this semester.

All components of your final project are due by 11:59pm Dec. 13, 2021.