Statistically Speaking Lecture Series
Sponsored by the Biostatistics Collaboration Center

Biostatistics Collaboration at Northwestern: Finding Your Way to A Friendly Statistician

Leah Welty, PhD, BCC Director, Professor
Denise Scholtens, PhD, Division Chief, NUDACC Director, Professor
Masha Kocherginsky, PhD, QDSC Director, Professor
Introduction and Welcome
Finding your way to a friendly statistician

- Division of Biostatistics
- Biostatistics Collaboration Center (BCC)
- Quantitative Data Sciences Core (QDSC)
- Northwestern University Data Analysis and Coordinating Center (NUDACC)
- General Information
The Division of Biostatistics engages in statistical methods development and application, research design and statistical computing for health science research.

- ~20 biostatistics faculty
- ~20 statistical analyst / biostatistician / data manager staff

- Clinical research
- Basic science
- Health services
- Population health
What We Do

Many areas of expertise, including:
- Bayesian Methods
- Big Data
- Bioinformatics
- Causal Inference
- Clinical Trials
- Database Design
- Genomics
- Longitudinal Data
- Machine learning
- Missing Data
- Reproducibility
- Statistical genetics
- Survival Analysis

Many types of software, including:
- Python
- R
- Stata
- SAS
- REDCap
- East Software
- PASS 2019
Division of Biostatistics

Overview

The Division of Biostatistics engages in statistical methods development and application, research design and statistical computing for health science research.

Division of Biostatistics faculty accomplishments

• High impact collaborative and statistical methodology publications
• Grant funding as PI, MPI and Co-I
• Highly accessed open source software
• American Statistical Association fellows and leaders
• Award winning biostatistics instructors
• Dissertation committee chairs
• Internationally and nationally recognized biostatisticians
• Study section members
• Journal editorial positions
Division of Biostatistics

Overview

The Division of Biostatistics engages in statistical methods development and application, research design and statistical computing for health science research.

Division of Biostatistics staff accomplishments

• Masters degrees in statistics/biostatistics or data fields
• Programming prowess
  R, SAS, Stata, SQL, Python, Shell scripting
• Reproducible research experts
  RMarkdown, Git, StatTag
• Database set up and quality assurance pipelines
  REDCap
• Lead authors, conference presenters
• Classroom instructors and award winning TAs
Division of Biostatistics

Once upon a time...a long, long time ago (about 15 years ago at NU)

I need a statistical collaborator!
I am looking for a statistical collaborator. I anticipate more data than ever before, and it is complex!
Biostatistics Resources
Overview

- Biostatistics Collaboration Center (BCC)
  - Supports non-cancer research at NU
  - Provides investigators an initial 1-2 hour consultation

- Biostatistics Research Core (BRC)
  - Supports Lurie Children’s Hospital affiliates
  - Stanley Manne Research Institute at Lurie Children’s

- Quantitative Data Sciences Core (QDSC)
  - Supports all cancer-related research at NU
  - Provides free support to all Cancer Center members subsidized by RHLCCC
  - Grant

- Northwestern University Data Analysis and Coordinating Center (NUDACC)
  - Supports prospective, multicenter research
  - Spans the full life cycle of research
  - Grant
Biostatistics Collaboration Center (BCC)
Mission: to support investigators in the conduct of high-quality, innovative health-related research by providing expertise in biostatistics, statistical programming, and data management.

Annual Numbers

• Help submit ~90 grant proposals per year, > $250M

• Work with ~200 different principal investigators and their teams

• More than 250 different research projects across FSM, Northwestern Medicine, McCormick, School of Communication, Lurie Children’s, Abilitylab and more …

• All non-Cancer related projects
BCC: Biostatistics Collaboration Center

How do we do it?

Every Northwestern affiliated investigator is provided an initial 1-hour consultation, subsidized by FSM Office for Research.

Who is eligible?
- (Research) Asst/Assoc/Full Professor
- Graduate Student
- Fellow/Postdoc
- Research Coordinator
- Nurse
- Resident
- Anyone NU affiliated with a (non-cancer) research question

What happens in an initial consultation?
- We learn about your project
- You learn about what we might be able to do

How often can I go back for an initial consultation?
- 1 per project (e.g., grant submission, manuscript)
Grant writing is supported by FSM at no cost to the investigator, with the goal of establishing successful collaborations.

- Study design
- Sample size calculations/power
- Data analysis plans
- Developing (testable) specific aims
- BCC faculty/staff typically included as Co-I/Biostatistician with appropriate % effort to conduct the proposed work.
- Available to all investigators to full-time FSM faculty at the level of instructor or higher.
- We spend > 450 hours/year writing grants. The largest portion of our time is spent working on them when they are funded.
BCC: Biostatistics Collaboration Center

How do we do it?

For projects that require biostatistics expertise but are limited in scope and do not require a biostatistician funded at % effort, the BCC supports a re-charge/fee-for-service model.

- Hourly rates are $125-$150 per hour.
- NIH cost study approved
- Some projects may qualify for NUCATS Tier 1 vouchers to offset costs. [https://www.nucats.northwestern.edu/funding/pilot-funding/nucats-voucher-and-pilot-programs.html](https://www.nucats.northwestern.edu/funding/pilot-funding/nucats-voucher-and-pilot-programs.html)
The BCC also partners with the Shirley Ryan Abilitylab and the Stanley Manne Research Institute at the Ann & Robert H. Lurie Children’s Hospital to provide additional expertise to those investigators.

- Abilitylab investigators should submit a request to the BCC.
- Lurie Children's investigators should submit a request to the BRC (Biostatistics Resource Core)
  https://www.luriechildrens.org/en/research/research-areas/clinical-research/biostatistics-research-core/
BCC: Biostatistics Collaboration Center

How do you find us?

https://www.feinberg.northwestern.edu/sites/bcc/
BCC Collaboration: HANDS
A Multi-Center Clinical Trial to Evaluate the Effectiveness of Intermittent Hypoxia Therapy in Individuals with Spinal Cord Injury

William Rymer, MD, PhD partnered with the BCC to develop a multi-site clinical trial for innovative treatment of spinal cord injury (SCI)

Masha Kocherginsky, PhD, helped write the grant proposal. She developed clinical trial design and analysis plan, calculated sample size, and leads the Statistics and Data Coordination Core

Elizabeth (Lib) Gray, MS worked with HANDS team to design the CRF’s, developed the REDCap database, implemented the randomization in REDCap, developed ongoing quality reports
BCC Collaboration: Less harmful detection of disease

• Can pulmonary function tests (FVC and DLCO) be used to diagnose lung disease without radiation exposure?

• Investigators partnered with David Aaby, MS, and Julia Lee, PhD to develop an analysis plan and use registry data at NU

• AUCs of 0.74 and 0.71

• AUC guidelines:
  - 0.70–0.90 considered “moderately accurate,”
  - >0.90 considered “highly accurate”

Figure 1.
Receiver-operating characteristic curves for % predicted forced vital capacity (FVC) and DLCO, demonstrating the performance of varying FVC and DLCO % predicted cutpoints for associated radiographic interstitial lung disease in systemic sclerosis.
BCC Collaboration: Data Reduction
Collaboration with Lurie Children’s investigators, Drs. Alonso and Chapin, via the BRC

- 40% of pediatric liver failure cases have no identifiable etiology

- Drs. Alfonso and Chapin (Lurie Children’s) partnered with Nina Srdanovic, MS and Lauren Balmert, PhD via the BRC to investigate the role of cytokines

- 41 cytokines on 20 patients

- Principal components analysis used for data reduction

Abstract presented at Am Assoc for the Study of Liver Diseases, manuscript preparation in progress
RHLCCC Quantitative Data Sciences Core (QDSC)
QDSC: Quantitative Data Sciences Core
Collaborative biostatistics for cancer research

Mission: provide state-of-the-art integrated data science support to Robert H. Lurie Cancer Center (RHLCC) members engaged in basic, translational, population, and clinical research in all programs

- QDSC has faculty and MS-level analysts in
  - Biostatistics
  - Bioinformatics
  - Clinical Informatics

- Collaboration within QDSC
  - Biostatistics – Bioinformatics: study design and analysis
  - Biostatistics/Bioinformatics – Clinical Informatics: data collection, storage and database design
QDSC: Quantitative Data Sciences Core

QDSC structure

Masha Kocherginsky, PhD
Director, QDSC

Denise Scholtens, PhD
Associate Director, Biostatistics

Matthew Schipma, PhD
Associate Director, Bioinformatics

Firas Wehbe, MD, PhD
Associate Director, Clinical Informatics

Biostatistics Faculty and Analysts

Bioinformatics Faculty and Analysts

Clinical Informatics Faculty and Analysts
QDSC: Quantitative Data Sciences Core

Biostatistics Sub-Core

• Clinical trial design and analysis
  - Development of Investigator Initiated clinical trials
  - Phase I and II clinical trials
  - Standard and innovative clinical trial designs

• Grant development
  - research study design – from basic science to population studies
  - experimental design and planning
  - power and sample size calculations
  - development of statistical analysis plans

• Statistical data analysis
  - wide variety of statistical analysis methods

• Manuscript writing
QDSC: Quantitative Data Sciences Core

What we work on

- Since August 2018:
  - 134 new projects
  - 39 projects involved development of new or analysis of on-going clinical trials
  - 42 projects involve study planning, experimental design or power calculations

- Recently funded major collaborative grants:
  - Brain SPORE
  - U54 Study of HIV-Associated Cancers in Nigeria
  - NU IMPACT
  - Cancer Prevention Clinical Trials Network
QDSC: Quantitative Data Sciences Core

Operations

- QDSC is supported by the NCI Cancer Center Support Grant (CCSG) and the Robert H. Lurie Cancer Center.

- LCC members are eligible for QDSC support at no cost, for projects without designated funding.

- Grant development: expectation that a faculty statistician and a statistical analyst are included with appropriate % effort.

- We also work with other cancer researchers, including medical and graduate students, residents and fellows.
  - Such projects require participation of an LCC member, including presence at the initial meeting.
QDSC: Quantitative Data Sciences Core

Requesting Support

- Project tracking system for QDSC (*all sub-cores*)
  - REDCap-based system
  - Facilitates project management and reporting
- Project requests **must be submitted** for all new projects
- To request QDSC support:
  - Submit Project Description/Appointment Request form
  - You can request a particular QDSC collaborator in the “Comments” field
  - Your project will be routed to a QDSC member

- **Project Description/Appointment Request Form:**
  - [https://redcap.nubic.northwestern.edu/redcap/surveys/?s=7YAAR3YFHJ](https://redcap.nubic.northwestern.edu/redcap/surveys/?s=7YAAR3YFHJ)
QDSC: Quantitative Data Sciences Core

Quantitative Data Science Core

QDSC Project Description and Appointment Request

Please fill out the below form in order to ensure the best possible collaboration. You will receive a confirmation email upon successful submission of your request and we will contact you shortly for further arrangement. Visit the services page for general guidelines to help you prepare for a consultation with the Quantitative Data Science Core.

Request Date

Project Deadline

Principal Investigator First Name

Principal Investigator Last Name

Principal Investigator NETID

Principal Investigator e-mail address

Contact e-mail address

Principal Investigator Title

Institutional Affiliation

Department/Division

Are you the PI on this project?

Contact phone number

Title of Project

Brief description of project (e.g. objectives, methods, data)

Is this study already associated with an IRB protocol? If so please enter the protocol number which starts with "STUDY".

Has this study already been assigned a Cancer Center protocol? If so please enter that protocol ID if you have it.

Type of Collaborative Service Requested (Check all that apply)

- Grant writing
- Analysis of results interpretation
- Data analysis
- Data monitoring/quality control
- Database creation
- Experimental design
- Clinical trial design
- Form design
- Manuscript preparation
- Abstract/poster presentation
- Randomization
- Respond to reviewers comments
- Sample size determination/power calculation
- Survey design
- Obtain clinical data
- Obtain clinical samples
- Bioinformatics support
- Research website

How did you hear about us?

Have you worked with the QDSC before?

Comments

Submit
QDSC Collaboration: Predicting Lymphedema in Breast Cancer

Development and Validation of a Nomogram to Predict Lymphedema After Axillary Surgery and Radiation Therapy in Women With Breast Cancer From the NCIC CTG MA.20 Randomized Trial (Int J. Rad Onc, 2019)

- Dr. Strauss sought to develop a risk calculator for occurrence of lymphedema in breast cancer patients undergoing radiation treatment
- Used data from randomized Phase III clinical trial (MA.20) and identified 3 main risk factors:
  - BMI, extent of auxillary surgery, nodal irradiation
- Statistical methods included:
  - Logistic regression, multiple imputation, bootstrap
- External validation using external cohort (NM patients):
  - Concordance Index 0.71
Minimally Invasive Surgery Leads to Worse Survival for Cervical Cancer Patients (NEJM, 2018)

- Minimally invasive surgery for early stage cervical cancer
  - an alternative to open surgery for radical hysterectomy
  - adopted before high-quality evidence regarding its effect on survival was available.
- Dr. Shahabi partnered with QDSC to examine the effect of minimally invasive surgery on all-cause mortality using NCDB database
- Found the risk of death within 4 years was 9.1 percent in MIS as compared to 5.3 percent in the open surgery group (HR=1.65)
- High-profile publication in NEJM, with Drs. Shahabi and Kocherginsky as senior co-authors
Northwestern University Data Coordinating Center (NUDACC)
MISSION: to harmonize all components of the clinical research study life cycle through interdisciplinary collaboration and leadership within Northwestern University Feinberg School of Medicine and across our partner institutions.

How do we accomplish this?

• Study Design and Development
• Data Coordinating
• Statistical Analyses
  • Cross cutting with Division, BCC, QDSC
• Grant writing
  1. Independent U grant submissions as PI
  2. Companion R submissions (clinical + data centers)
  3. MPI / Co-I on R grants with substantial team effort
**NUDACC: Northwestern University Data Analysis and Coordinating Center**

**Study Design and Development**
- Prospective clinical or observational research study design
- Sample size and power
- Randomization procedure development
- Recruitment and feasibility studies
- Protocol and Manual of Operations development
- Data Management Plan development
- Data and Safety Monitoring Plan development

**Data Coordinating**
- Data collection tool development, e.g. CRFs
- Database construction and maintenance
- Programming of automated range, logic and consistency checks
- Data query management and resolution
- De-identification and data security
- Regulatory and ethics committee reporting including Data and Safety Monitoring Board (DSMB) reporting

**Statistical Analyses**
- Statistical analysis plan development
- Interim statistical analyses
- Final statistical analyses
- Manuscript development and dissemination of findings
- Ancillary study development
- Methodologic innovation
When do I come to NUDACC?

- Is your study a multi-site, prospective, human research study?
- Are you submitting a large R, U or P to NIH?
- Do you intend to allocate substantial effort and resources in data management, ongoing quality assurance and regulatory reporting?
- Will your study require a single IRB?
- Will you need to develop case report forms?
- If you start to answer YES to a few of these, you may want to reach out to NUDACC.
What we can do for you and when
General Biostatistics Advice

When should you find us?

• Hundreds of grants submitted/year, many of them are January 5, June 5, and October 5.

• For example, the BCC submits a grant about every 4 days if you average out over the year. But what that really means is 20+ grant submissions per cycle.

• Come early (6 or more weeks!), and involve biostatisticians in the writing and development process.

• We are logical thinkers, good reviewers, and have seen a lot of specific aims.

• For grant requests submitted within days of a deadline, the BCC and QDSC can provide a Letter of Support detailing availability. It’s unlikely we will be available to make substantive contributions.
Biostatistics Guidelines: Authorship & Ethics

We follow the International Committee of Medical Journal Editors’ authorship guidelines.

• One criterion for authorship: “Substantial contributions to [. . . ] the acquisition, analysis, or interpretation of data”

• “individuals who meet the first [above] criterion should have the opportunity to participate in the review, drafting, and final approval of the manuscript.”

• Payment does not replace authorship (or vice versa)

We also adhere to the American Statistical Association’s Ethical Guidelines for Statistical Practice

• Good statistical practice is fundamentally based on transparent assumptions, reproducible results, and valid interpretations.


https://www.amstat.org/ASA/Your-Career/Ethical-Guidelines-for-Statistical-Practice.aspx?hkey=85085cd1-5dfc-4fb9-b526-e3c6d45abc0d
Contact Information

• Biostatistics Collaboration Center (BCC)
  - Website: http://www.feinberg.northwestern.edu/sites/bcc/index.html
  - Email: bcc@northwestern.edu
  - Phone: 312.503.2288

• Quantitative Data Sciences Core (QDSC)
  - Website: https://www.cancer.northwestern.edu/research/shared-resources/quantitative-data-sciences.html
  - Email: qdsc_rhlccc@northwestern.edu
  - Phone: 312.503.2288

• Biostatistics Research Core (BRC)
  - Website: https://www.luriechildrens.org/en/research/research-areas/clinical-research/biostatistics-research-core/
  - Email: mereed@luriechildrens.org
  - Phone: 773.755.6328

• Northwestern University Data Analysis and Coordinating Center (NUDACC)
  - Website: https://www.feinberg.northwestern.edu/sites/nudacc/
  - Email: nudacc@northwestern.edu
Your feedback is important to us! (And helps us plan future lectures)
Statistically Speaking: Upcoming Lectures

We hope to see you again!

Tuesday, November 19
Protocol Development and Review from a Biostatistical Perspective
Jody Ciolino, PhD, Associate Professor, Division of Biostatistics, Department of Preventive Medicine

Wednesday, January 15
To p or not to p: reflections on recent p-value statements
Mary Kwasny, ScD, Professor, Division of Biostatistics, Department of Preventive Medicine

Wednesday, March 18
Biostat Basics: Some Practical Things to Know
Nina Srdanovic, MS, Statistical Analyst, Division of Biostatistics, Department of Preventive Medicine

Monday, May 11
Logistic Regression: Odds & Ends
Lauren Balmert, PhD, Assistant Professor, Division of Biostatistics, Department of Preventive Medicine

All lectures will be held from Noon to 1 pm in Baldwin Auditorium, Robert H. Lurie Medical Research Center, 303 E. Superior St.