This course covers practical aspects of conducting a population-based research study. Concepts include determining a study budget, setting a timeline, identifying study team members, setting a strategy for recruitment and retention, developing a data collection protocol and monitoring data collection to ensure quality control and quality assurance. Students will demonstrate these skills by engaging in a quarter-long group project to draft a Manual of Operations for a new "mock" population study.

BIOSTAT 429-0 Systematic Review and Meta-Analysis in the Medical Sciences (1 Unit)
This course covers statistical methods for meta-analysis. Concepts include fixed-effects and random-effects models, measures of heterogeneity, prediction intervals, meta regression, power assessment, subgroup analysis and assessment of publication bias. The course will emphasize basic theory and underlying statistical methods, computational approaches and interpretation of results from published studies.

BIOSTAT 445-0 Introduction to Statistical Learning (1 Unit)
Due to advances in technology and data collection, the ability to analyze complex data sets is a necessary skill for all clinical, translational and population researchers. A variety of data analysis tools exist, some unique to specific domains. This course provides an introduction to the data, analysis tools, ethical considerations, and terminologies from across biomedical data science with an emphasis on clinical, translational and population methods and tools. Prerequisite BIOSTAT 302-0.

BIOSTAT 446-0 Design, Conduct & Analysis of Clinical Trials (1 Unit)
This course introduces commonly used designs for clinical trials, methods for randomization, blinding and sample size determination, choice of controls, collaborative/multicenter trial requirements and operational issues, data management and data quality issues, interim analysis methods, critical review of clinical trial results and statistical techniques for analyzing data. Prerequisite BIOSTAT 305-0 and BIOSTAT 402-0.

BIOSTAT 499-0 Independent Study (0.5-1 Unit)
This is Independent Study course is designed to give students a hands-on practical training on statistical analysis. This course will offer 4 statistical consultation projects -- real case study. Students will be given the data and a brief introduction of the data. Students will need to check the data, perform preliminary data analysis, orally present their statistical approach, modeling, findings, and interpretation of their result, and write a report for each project. Students will be evaluated by the quality of their oral presentation and project report.

BIOSTAT 501-0 Advanced Epidemiology (1 Unit)
This course builds on material learned in previous Biostatistics and Epidemiology courses. Concepts are applied to the design, implementation, analysis and interpretation of observational epidemiologic studies (cross-sectional, case-control and cohort). Students enrolled in an MPH degree program must have the consent of the instructor.

BIOSTAT 502-0 Advanced Biostatistics (1 Unit)
This course covers modern approaches to the analysis of correlated response data arising from longitudinal studies commonly encountered in medical research and clinical trials. Concepts include marginal and mixed-effects regression models for continuous and discrete outcomes measured repeatedly over time, model building techniques, robust inference procedures and problems associated with missing data. All
modeling and numerical analyses will be done using SAS. Prerequisites include the equivalent of BIOSTAT 302-0, BIOSTAT 402-0.

**BIOSTAT 521-0 Survival Data Analysis (1 Unit)**
This course provides an introduction to the fundamental concepts and methods developed for analysis of survival data for which incompleteness, including censoring, is a primary feature. Classic non-parametric estimation approaches will be discussed, as will semiparametric and parametric hazard regression modeling techniques that allow incorporation of covariates. Analysis examples using both R and SAS will be discussed. 
Prerequisite: BIOSTAT 403-0.

**BIOSTAT 522-0 Network Data Analysis (0.5 Unit)**
This course introduces analytic methods and computational resources for network data analysis. It provides an overview dealing computationally with graph and network data structures, describing networks through node and edges statistics and overall topology, and identifying cliques and clusters in graphs. Gaussian graphical models, subnetwork identification and differential network analysis will be introduced.
Prerequisites: BIOSTAT 302-0, BIOSTAT 306-0, BIOSTAT 402-0.

**BIOSTAT 527-0 Statistical Methods for Missing Data (0.5 Unit)**
This course provides students with a basic knowledge of the potential implications of missing data on their data analyses as well as potential solutions. A major focus of the course is multiple imputation including discussions of the general framework, different models and algorithms, and the basic theory. Statistical programming is performed in R.
Prerequisites: BIOSTAT 306-0, BIOSTAT 402-0, BIOSTAT 403-0.

**BIOSTAT 529-0 Statistical Genetics (0.5 Unit)**
This course equips students with key principles and practical skills to analyze genetic data. Topics range from linkage analysis using pedigree data to machine learning techniques using next-generation sequencing data. Statistical programming is performed in R.

**BIOSTAT 560-0 Statistical Consulting (0.5 Unit)**
This course prepares students for collaboration and communication with scientists of various disciplines, emphasizing analytical tools, verbal and written communication skills and presentation skills. Concepts include sample size and power calculation, handling of various data structures, data presentation, selecting appropriate statistical methods, time and project management, reproducible research, report writing and grant writing.
Prerequisites: BIOSTAT 302-0 and BIOSTAT 402-0.

**BIOSTAT 561-0 Thesis (0.5 Unit)**
All MS in Biostatistics students are required to submit a master's thesis focusing on a collaborative data analysis or a statistical methodology advancement. Thesis projects are proposed in the fall, and content is developed primarily in late fall / winter. Written, poster and oral presentations are due in the spring.

**BIOSTAT 565-0 Clinical Database Management (0.5 Unit)**
This course serves as an introduction to data management in the clinical research setting. The Research Electronic Data Capture (REDCap) platform is used to understand basic database design, data management and quality monitoring concepts for studies ranging from simple cross-sectional designs to complex multi-center clinical trials. Students enrolled in this course must complete CITI training through the Northwestern University IRB Office before the first class session.