How to Select Your Biostatistics Requirement

Department of Biostatistics
Options for the Biostatistics Requirement

- Biostatistics options (choose one)
  - Statistical Reasoning in Public Health (611-612)
  - Statistical Methods in Public Health (621-623 required, 624 is optional)
  - Methods in Biostatistics (651-654)
Why are there 3 options?

• Heterogeneous student population
  • Diverse backgrounds
  • Differing quantitative backgrounds
  • Varying needs

• What are the different desired skills?
  • Critical statistical reasoning and thinking
  • Understanding of statistical methods and techniques
  • Skills in performing data analysis
  • Understanding of statistical theory
Why would you want to develop data analysis skills?

• If you want to develop skills to have hands-on experience in using a data set to do research or program evaluation. For example:
  – Assess relationships between risk factors and disease status
  – Evaluate a health program or treatment regimen
  – Analyze outcome or performance between two groups or programs over time
  – etc.
Types of Students

• “Consumer” - wants to develop skills for critical reading of the literature and reviewing of research proposals

• “User” - wants to develop additional computational skills and hands-on experience in analyzing data sets (data analysis skills)

• “Advanced” - has more advanced mathematical skills and wants to understand statistical techniques in more depth (theoretical underpinnings)
Description of the Options

• For the consumer: 3 credits x 2 terms = 6 credits
  Statistical Reasoning in Public Health (611-612)
  – 2 terms; 2 lectures per week; no labs; minimal computing
• For the user: 4 credits x 4 terms = 16 credits
  Statistical Methods in Public Health (621-623)
  – 4 terms; 2 lectures per week; 1 lab; other sessions
  – statistical computing using Stata statistical analysis package
• For the advanced: 4 credits x 4 terms = 16 credits
  Methods in Biostatistics (651-654)
  – 4 terms; 2 lectures per week; 1 lab; statistical computing using R statistical analysis package
What topics are covered in all 3 options?

• The topics of all 3 options:
  – Causal reasoning
  – Summarizing data: exploratory data analysis, tables and graphs
  – Probability concepts and distributions
  – Hypothesis testing and confidence intervals
  – p-values and statistical significance
  – Sample size and power
  – Linear and logistic multivariable regression analysis
  – Survival analysis and Cox regression analysis
How do the options differ?

- **Biostatistics 611-612** involves minimal calculation/computing.
- **Biostatistics 621-624** and **Biostatistics 651-654** teach the tools and techniques of data analysis. Both sequences uses computers and statistical analysis packages.
- **Biostatistics 651-654** explains statistical techniques in more depth and requires students to have more advanced mathematical skills.
How do students typically distribute across the sequences?

- **Statistical Reasoning in Public Health (611-612)**
  - 130+ students on campus
  - 220+ students on line

- **Statistical Methods in Public Health (621-624)**
  - 450+ students
How do students typically distribute across the sequences?

- **Methods in Biostatistics (651-654)**
  - 50+ students
How does a student choose the introductory sequence?

- The Departments have requirements for non-MPH degree candidates.
- The MPH student will need to assess his/her own:
  - Mathematical skills and aptitude based on
    - Familiarity with mathematics, algebra
    - Performance in previous quantitative courses
  - Professional needs or ambitions
But HOW will I choose the best option for me?

- Would you like an overview of biostatistical concepts and methods in two terms with minimal focus on computing and calculations and limited hands-on data analysis? If YES → **Statistical Reasoning ( 611-612)**
But HOW will I choose the best option for me?

- Are you seeking the ability to conduct, or actively participate in, the design and data analysis for a public health practice or research program? If YES → **Statistical Methods in Public Health (621-624)**
But HOW will I choose the best option for me? (continued)

• If you seek design and data analysis skills, do you have a working knowledge of linear algebra and multivariate calculus from your previous training? If YES → **Methods in Biostatistics (651-654)**
Example: Characteristics Associated with Risk of Event

- Multivariable Cox Proportional Hazards Model

<table>
<thead>
<tr>
<th></th>
<th>Hazard Ratio for Event (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low SES (vs. High SES)</td>
<td>2.7 (1.6 – 6.3)</td>
<td>0.04</td>
</tr>
<tr>
<td>Male (vs. Female)</td>
<td>4.5 (0.4 – 13.2)</td>
<td>0.21</td>
</tr>
</tbody>
</table>

- 611-612 – Interpret results
- 621-624 – Interpret results and calculate from a data set using Stata
- 651-654 – Interpret results, calculate from a data set, plus theoretical development
FAQ1: Who takes Biostat 651-654?

- Students whose interests or main professional goals are to analyze data (Biostatistics graduate students, other PhD student earning joint MHS degree)
- Students with strong mathematical abilities who recently have had a year of calculus and a course in linear algebra
FAQ2: I had calculus 15 years ago. Could I still take Biostat 651-654?

• Possibly. Some review and self-study may be necessary.

• You should be able to:
  – Perform algebraic manipulations.
  – Graph an exponential function.
  – Find values that minimize a function by setting the first derivatives equal to zero.
  – Perform an integration.
  – Find the product of AB where A is a 2x3 matrix and B is a 3x2 matrix.
FAQ3: I am seriously considering applying to a doctoral program....

• What option should I take if I plan to apply to a JHBSPH doctoral program next year?
• Check the course requirements for doctoral students in the Department of interest. Many programs require Biostat 621-624.
FAQ4: How comfortable must I feel with math or computers?

• A recent randomized study by Boyd indicated:
  – Variables associated with good performance in Biostat 621 were:
    • Comfort with mathematical concepts
    • Comfort with computers
    • Not employed > 10 hours per week
  – Variable associated with decreased performance in Biostat 621:
    • Belief: “I think that I will need a tutor”
  – English as a native language is not a predictor of performance
FAQ5: Could I switch sequences during the school year?

• No, this is not possible. Although the sequences cover roughly similar topics, the topics are not taught in necessarily the same order or time frame.

• If you decide to drop Biostat 621-623 at the end of the first term, you must take Biostat 611-612 during the June Summer Institute in order to complete your requirements within the academic year (or the next year).
FAQ6: I’m really not sure of my career plans.....

• Should I take Biostat 621-624 just in case I find a job that requires data analysis skills?
• Learning data analysis skills is not like learning how to ride a bicycle. If you don’t use the skills, you lose them.
• It would be preferable to take a data analysis course nearer the time that you accept the job.
FAQ7: Suppose I want more at the end of Biostat 611-612?

• Suppose I would like to gain additional data analysis skills?
• There are three 1-week intensive data analysis workshops offered during the Winter and Summer Graduate Institutes in Epidemiology and Biostatistics.
FAQ8: Why is Stata used in Biostat 621-624 rather than SAS?

- Biggest reason: Stata can be purchased inexpensively ($195) by students for use on their own computers. See www.stata.com/gpdirect
- One can perform the same procedures in Stata as in SAS.
- The graphics abilities of Stata are better than those of SAS.
- Stata has good manuals and useful Help features.
FAQ9: Why isn’t Biostat 624 required as part of the option?

• Biostat 621-623 covers methods through multivariable regression procedures.

• Biostat 624 provides:
  – Concentrated review of statistical methods
  – Some advanced topics (e.g., data analysis for correlated observations)
  – Data analysis project of your choosing to pull it all together!