CLASS SESSIONS
Wednesdays, 8:30 AM - 11:20 AM, HSL LL204

INSTRUCTOR
Nan Liu, Ph.D.
600 West 168th Street, Room 603
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Office hour: Friday 4-5pm.

TEACHING ASSISTANTS
Naomi Kruger (Tue 2-3pm @ Room 610)
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COURSE DESCRIPTION
This course will introduce health care management students to the fundamentals of social science research methodologies, including research designs, data collection, and statistics. In addition, this course will introduce students to basic operations research/management (OR/OM) techniques and discuss how they can be applied in health service management. A basic knowledge of these methods is essential for anyone who manages an enterprise, conducts research, or formulates policies. The class takes a problem-based, participatory approach to learning. Data management and analysis are conducted using Excel.

PREREQUISITES
P6103 or P6104: Introduction to Biostatistics (or other equivalent courses)

COURSE COMPETENCIES AND LEARNING OBJECTIVES
The faculty of the Department of Health Policy and Management has adopted a carefully researched Competency Model to guide the design of all courses in the Management curriculum. Each course is explicitly charged with reinforcing and developing further a number of the key Competencies identified in the Model. This course focuses specifically on the following competencies:

- Analytical thinking – breaking down problems, understanding and assess basic relationships, and recognizing and analyzing complex relationships;
- Innovative thinking – recognizing, explaining, and predicting patterns;
- Resource management and allocation – understanding techniques for performance improvement;
- Apply biostatistical and epidemiological methods to health policy and management problems on the population level – applying biostatistical methods to health management problems on the population level.

These competencies are reflected and implemented throughout all activities in the course. Students who successfully complete this course will be able to:
1. Discuss basic research design theory and data collection methods;
2. Apply appropriate statistical methods to analyze data and present results;
3. Understand basic OR/OM methods and their applications in health services management;
4. Formulate appropriate spreadsheet analytics models to address challenges in managing health care operations;
5. At the end, students will
   - be familiar with the fundamental analytic methods used in health services management,
• be equipped with necessary methodological foundation to learn more advanced analytic methods,
• be able to read and comprehend research papers/project reports.

COURSE REQUIREMENTS

Homework policy
1. There are totally 12 homework assignments. The one with the lowest grade will be dropped from the calculation of overall homework grades. Each homework assignment accounts for 3.64% of the final grade.
2. Homework assignments will be posted on the Courseworks website after each lecture, and is due in one week. Please use analyticmethods2014@gmail.com for online submission. Late submissions will NOT be accepted and will receive a ZERO grade.

Final exam
The final exam is an open-book, open-notes and take-home exam. It will be posted on Courseworks on Thursday, May 1 (by 5pm). You need to use Excel in the exam. You are required to work on this exam only by yourself. You are NOT allowed to work with anyone else on the exam or consult anyone else, though you may consult the instructor for clarification questions. The final exam is due on Thursday, May 8 (5pm). Late submissions will NOT be accepted. The exam need to be typed in a Word (or Excel) document and submitted electronically to analyticmethods2014@gmail.com.

Class participation and attendance
Class participation is highly valued and strongly encouraged. To make the learning process much more beneficial and enjoyable, you are expected to contribute to class discussions.

CRITICAL DATES

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>Jan 29</td>
<td>First class</td>
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<tr>
<td>April 30</td>
<td>Last class</td>
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<tr>
<td>May 1</td>
<td>Take-home final exam posted on Courseworks by 5pm</td>
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<tr>
<td>May 8</td>
<td>Take-home final exam due by 5pm</td>
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COURSE STRUCTURE
The course content can be obtained in class lectures, in-class exercises, homework and readings. Class may be divided into PC section (LL204) and Mac section (LL205) during lab hour if needed.

ASSESSMENT AND GRADING POLICY
Student grades will be based on:
Homework assignments  40%
Take-home final exam  50%
Class participation   10%

FEEDBACK
Your feedback is important for the success of this course. Please feel free to talk to the instructor, drop him a note or send him an email to share your views with him.

COURSE WEBSITE
http://courseworks.columbia.edu
READING MATERIALS
Required Textbook

Reading Materials
- Reading materials can be downloaded from the course website or will be distributed in class.

References (not required to buy)
- Ozcan, Yasar. *Quantitative Methods in Health Care Management: Techniques and Applications*, 2005 (or newer versions).

Excel References (not required to buy)
  Login using your uni/password. Select Catalog of Courses, Course Curricula and then Desktop Curricula. Select your version of Office and there you will find Excel Beginning/Excel Advanced/Excel Power User.

MAILMAN SCHOOL POLICIES AND EXPECTATIONS
Students and faculty have a shared commitment to the School’s mission, values and oath. http://mailman.columbia.edu/about-us/school-使命/

Academic Integrity
Students are required to adhere to the Mailman School Honor Code, available online at http://mailman.columbia.edu/honorcode.

Disability Access
In order to receive disability-related academic accommodations, students must first be registered with the Office of Disability Services (ODS). Students who have, or think they may have a disability are invited to contact ODS for a confidential discussion at 212.854.2388 (V) 212.854.2378 (TTY), or by email at disability@columbia.edu. If you have already registered with ODS, please speak to your instructor to ensure that s/he has been notified of your recommended accommodations by Lillian Morales (lm31@columbia.edu), the School’s liaison to the Office of Disability Services.
# COURSE SCHEDULE
Please log into Courseworks to download the lecture slides, readings, homework and exams.

## Session 1 – Overview
**Jan 29**  
**Learning Objectives:**  
- Provide an overview of the course  
- Review basic probability and statistics (concepts, probability distributions, descriptive statistics, confidence intervals, hypothesis testing)  

**References:**  
- Lecture notes of P6103 Introduction to Biostatistics (FT MGT Track)  

**Assignment:**  
- Problem Set #1 handed out, due Feb 5.  

**Lab:**  
- Excel basics: descriptive statistics, confidence intervals, hypothesis testing.

## Research Design, Statistics and Simple Decision Analysis

## Session 2 – Research Design  
**Feb 5**  
**Learning Objectives:**  
- Introduce foundations of research design  
- Discuss theory and models  
- Describe “casual relationship” and different research designs  
- Introduce the concepts of internal and external validity  
- Discuss data collection, sampling techniques and survey questionnaire design  

**References:**  
- Meier, Chapter 3.  
- Section 1.5. Questionnaire Design in Sampling: Design and Analysis by Sharon Lohr (2010).  

**Assignment:**  
- Problem Set #2 handed out, due Feb 12.  

**Lab:**  
- Review: ANOVA in Excel.

## Session 3 – Multiple Linear Regression (Basic Concepts)  
**Feb 12**  
**Learning Objectives:**  
- Review assumptions and application context for linear regression  
- Understand basic steps to conduct linear regression analysis  
- Introduce confidence intervals for mean response and prediction intervals for individual response in simple linear regression (new)  
- Discuss how to test portions of a multiple regression model (new)  
- Discuss dummy variables and interaction terms in regression models (new)  

**References:**  
- Levine, Chapters 13 & 14.  

**Assignment:**  
- Problem Set #3 handed out, due Feb 19.
### Lab:
- Linear regression in Excel.

### Session 4 – Multiple Linear Regression (Model Development and Diagnosis)

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<th>Date</th>
<th>Learning Objectives:</th>
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<tr>
<td>Feb 19</td>
<td>Describe variable transformation techniques in linear regression (log, square-root, quadratic)</td>
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<td>Learn how to build a regression model, using either stepwise or best-subsets approach</td>
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<td>Introduce the concepts of (multi)collinearity</td>
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<td>Discuss how to avoid pitfalls involved in developing a multiple regression model</td>
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**References:**  
- Levine, Chapter 15.

**Assignment:**  
- Problem Set #4 handed out, **due Feb 26**.

**Lab:**  
- Linear regression in Excel.

### Session 5 – Analysis of Nominal and Ordinal Data

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<tr>
<th>Date</th>
<th>Learning Objectives:</th>
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<tbody>
<tr>
<td>Feb 26</td>
<td>Review contingency tables and Chi-square test</td>
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<tr>
<td></td>
<td>Introduce measures of association for categorical data: Gamma and Lambda</td>
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<td></td>
<td>Analyze multidimensional contingency tables using statistical control tables</td>
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<td></td>
<td>Review logistic regression</td>
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<td>Summarize a roadmap for analyzing data</td>
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**References:**  
- Levine, Chapter 2, 12, 14  
- Meier, Chapters 15, 16, 17.

**Assignment:**  
- Problem Set #5 handed out, **due Mar 5**.

**Lab:**  
- Introduce pivot tables in Excel.

### Session 6 – Decision Making

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<tr>
<td>Mar 5</td>
<td>Introduce different decision criteria</td>
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<td>Construct and use decision trees to examine decision alternatives</td>
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<td>Make decisions with Bayesian updates</td>
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**References:**  
- Levine, Chapter 19

**Assignment:**  
- Problem Set #6 handed out, **due Mar 12**.

**Lab:**  
- Decision analysis in Excel.
### Session 7 – Optimization (Introduction)

**Mar 12**  
**Learning Objectives:**  
- Outline operations research methods and their applications to health services management  
- Introduce linear programming (LP)  
- Understand the formulation of an LP model  
- Introduce the graphical method to solve 2-dimensional LP problems  
- Solve LP problems using Excel Solver  

**References:**  
- Ozcan, Chapter 10 (ignore the software part).  

**Assignment:**  
- Problem Set #7 handed out, due Mar 26.  
- Lab: Formulate LP models and solve them using Excel Solver.

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### Spring Break

**Mar 19**

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### Session 8 – Optimization with Excel Solver (Modeling Applications)

**Mar 26**  
**Learning Objectives:**  
- Analyze problems by formulating appropriate optimization models in Excel  
- Use Excel Solver to solve these problems  
- Understand the implementation of the solutions  

**References:**  
- Ozcan, Chapter 10 (ignore the software part).  
- McLaughlin and Hays, Chapter 6 (pp. 157-161) and Chapter 12 (pp. 346-350).  

**Assignment:**  
- Problem Set #8 handed out, due Apr 2.  
- Lab: Formulate LP models and solve them using Excel Solver.

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### Session 9 – Queueing Theory

**Apr 2**  
**Learning Objectives:**  
- Define the components of a queueing system  
- Discuss the applications of queueing models in health services management  
- Introduce the M/M/s queueing model  
- Analyze queueing models using QtsPlus (an Excel-based software)  
- Discuss psychology of waiting and its implication in management  

**References:**  
- Ozcan, Chapter 14 (ignore the software part) and Chapter 15.

**Assignment:**
- Problem Set #9 handed out, **due Apr 9.**

**Lab:**
- Analyze M/M/s queueing models using QtsPlus.

### Healthcare Operations Management

#### Session 10 – Forecasting

**Apr 9**

**Learning Objectives:**
- Introduce the concept of time-series analysis
- Discuss different forecasting techniques and use them appropriately
- The Mayo Clinic case
- Understand how statistics and OR/OM methods can be integrated to solve practical management problems

**References:**
- Levine, Chapter 16
- Chapter 3 Forecasting in *Operations Management* (11/e) by W.J. Steveson. ([link](http://highered.mcgraw-hill.com/sites/0073525251/information_center_view0/))

**Assignment:**
- Problem Set #10 handed out, **due Apr 16.**

**Lab:**
- Practice different forecasting techniques in Excel.

#### Session 11 – Quality Management

**Apr 16**

**Learning Objectives:**
- Introduce the theory of control charts
- Discuss the construction and use of different control charts
- Introduce the concepts of total quality management and Six Sigma

**References:**
- Levine, Chapter 18

**Assignment:**
- Problem Set #11 handed out, **due Apr 23.**

**Lab:**
- Develop control charts in Excel.

#### Session 12 – Healthcare Scheduling and Capacity Management

**Apr 23**

**Learning Objectives:**
- Use LP to make staffing decisions
- Understand and analyze different job scheduling and sequencing rules
- Describe patient appointment scheduling model
• Understand the tradeoff in determining a clinic appointment schedule
• Introduce the concept of Advanced Access (Open Access)

References:
• McLaughlin and Hays, Chapter 12.

Assignment:
• Problem Set #12 handed out, due Apr 30.

Lab:
• Analyze various problems in healthcare scheduling and capacity management; learn online appointment scheduling optimization tool: http://obp.math.vu.nl/healthcare/software/ges/.

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### Session 13 – Supply Chain Management in Healthcare

**Apr 30**

Learning Objectives:
• Introduce supply chain management basics and commonly-used terminologies
• Describe the Economic Order Quantity (EOQ) model
• Discuss different types of inventory control systems

References:
• McLaughlin and Hays, Chapter 13.

Assignment:
• This assignment will be included in the final exam.

Lab:
• The lab session is reserved for the final review of this class.