



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

HPM 770/779

Operations Research for Healthcare Systems

(No. Credit Hours: 3 (770)/ 4 (779))

Department of Health Policy and Management

Gillings School of Global Public Health

Syllabus **Spring 2019**

Class Location: MHRC 0001 (BCBS Auditorium) (770.002, RES)
<https://uncsph.adobeconnect.com/hpm779/> (779.967, EMP)

Meeting Times: Tuesdays/Thursdays 11:00a-12:15p (770.002, RES)
Tuesdays 7:30p-9:30p (779.967, EMP)

Instructors:	Alyssa Mansfield Damon, PhD, MHA, MPH Eddie Alcorn (779), MBA, MSPH Jenny Spencer (770), MSPH	TA:	Robert Carpenter (MHA student)
Office:	1106B McGavran-Greenberg (Damon)	TA:	Gina Thompson (MHA student)
Email:	*For course communication, contact instructors and TAs via Piazza tool on Sakai only*		
Office hours:	By appointment	Office Hours:	Tue 12:30-2pm (in-person, RO 116) Thu 12:30-2pm (in-person, RO 116) Sun 7-8:30pm ET (online, EMP)

Course Overview

This is an applied survey course of the most valuable Operations Research (OR) methods for health policy and management students. OR is an interdisciplinary branch of mathematics that uses mathematical modeling, statistics, probability, and algorithms to help make better decisions when facing complex problems. We will build models predominantly in Excel, using add-ons to expand the software's capabilities. We aim to develop students' abilities to 1) identify, define and contextualize focal problems; 2) use simple models (including spreadsheet and visual/conceptual models) to organize thinking; and 3) employ various techniques to analyze alternatives and reach a decision. After an introduction to modeling, the course is broken into 5 modules: Forecasting; Decision Analysis; Queuing and Sensitivity Analysis; Simulation; and Optimization. Each topic is self-contained; modules are nothing more than natural "break points" to pause and ensure key concepts have been learned.

This is a **problem-solving class** and the best way to learn the material is to work problems. Traditional lectures will be infrequent. Instead, we will spend most of our class time building models together to help solve prototypical problems students are likely to encounter in their careers. To facilitate this, it is essential to come to class prepared, having completed any assigned readings and with an understanding of key concepts. We will build on that basic knowledge during class time, solving sample problems to fill in gaps and increase understanding of how to best use a given OR tool. Students should review the sample problems prior to class and come ready to work through them with classmates and the instructor in the relevant session. In previous cohorts, there has been a strong, positive correlation between class preparation/engagement and final grades.

Learning Objectives and HPM Competencies

	<i>Course Learning Objective</i>	<i>HPM Competencies</i>	<i>Evaluation Method*</i>
1.	Correctly identify, explain, and contrast various operations research techniques relating to healthcare data	Data Analytics Systems thinking	<ul style="list-style-type: none"> ▪ Readiness Quizzes ▪ Homework Activities ▪ Module Review Tests ▪ Final Project
2.	Demonstrate the ability to successfully use Microsoft Excel and respective add-in software to correctly execute health-related and other problems using operations research tools.	Data Analytics Systems Thinking	<ul style="list-style-type: none"> ▪ Homework Activities ▪ Module Review Tests ▪ Final Project
3.	Effectively assess and communicate the potential of specific quantitative models to inform complex decisions.	Data Analytics Communication Skills Systems Thinking	<ul style="list-style-type: none"> ▪ Homework Activities ▪ Module Review Tests ▪ Final Project
4.	Answer health-related questions by drawing on mathematical modeling and substantive knowledge; critically review and analyze data; and interpret findings in a meaningful, succinct and professional manner.	Data Analytics Communication Skills Systems Thinking	<ul style="list-style-type: none"> ▪ Homework Activities ▪ Module Review Tests ▪ Final Project
5.	Effectively apply operations research methods to a novel issue, and present those applications to peers.	Data Analytics Communication Skills	<ul style="list-style-type: none"> ▪ Final Project

*see *Grade Components* and *Evaluation Criteria* subsections for detailed description

The programs taught in HPM have developed a set of competencies for Master's students that are addressed at multiple points throughout the individual programs, and in various courses. While the goal is for each of our students to achieve *mastery* (Level III) command of each competency, we expect each student upon graduation to have achieved *proficiency* (Level II) or higher.

Among the competencies noted above, the core competency integrated into the HPM 770/779 curriculum is **Data Analytics**. This competency is assessed at the individual level through a combination of Readiness Quizzes at the start of each new lesson; Module Review Tests at the end of related lessons; and a culminating Final Project. Each student's collective performance across these individual components of HPM 770/779 will be used to help determine individual competency achievement. The expectation is that upon completion of HPM this course, students will have achieved proficiency (Level II) in **Data Analytics**, defined as averaging 75% or higher across the three individual-level assessments noted above (combined).

The UNC Department of Health Policy and Management aims to create healthcare leaders, not merely graduate students with a particular set of skills. To that end, this course relies heavily upon individual and group participation and engagement, holds students responsible for their individual learning and achievement, and builds these elements into course assessment. As such, the HPM competencies of **accountability**, **interpersonal awareness**, and **professionalism** are integrated throughout the course and inherently assessed in various grade components.

Resources

Required Text (uses MS Excel 2016 for Windows; Excel 2016 is strongly recommended)

Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics (8th Edition), by Cliff T. Ragsdale, 2017, Cengage Learning. ISBN: 978-1305947412 (uses MS Office 2016). The text is available for purchase or rental from Amazon at the link below, and other sources.

https://www.amazon.com/Spreadsheet-Modeling-Decision-Analysis-Introduction/dp/130594741X/ref=sr_1_1?s=books&ie=UTF8&qid=1512675130&sr=1-1

NOTE: The text comes with access to software called Analytic Solver that we WILL NOT use in the course. We will instead be using software that is generally more accessible, user-friendly, or both. As a result, a used and/or rented version of the textbook is fine.

Recommended/Optional Texts (None)

Besides the required text, additional readings and other materials may be assigned and will be available on Sakai if not easily accessible via the web.

Requirements and Expectations

Computer and Software Requirements

Students will require a computer (not iPad or other tablet) for in-class activities and to complete homework activities, quizzes, and exams. As this is an Excel-based course, access to Microsoft Excel software is required either through a personal copy, or through UNC's Virtual Lab (<http://help.unc.edu/help/what-is-virtual-lab/>). We will be working through all problems in a Windows environment which may vary compared to Excel for Mac. In addition, this course utilizes add-in software designed for a Windows-based operating system. If using a Mac, one can either run Excel through a virtual machine program running Windows (e.g., Bootcamp, Parallels, VMWare Fusion, etc.), or using UNC's Virtual Lab.

Excel and Statistics Refresher: This class assumes a basic understanding of Excel and statistics and moves quickly. If you are fairly new to either—or find the need to refresh your skills—there are many excellent reference books and online resources (see *Helpful Links*). Additional resources may also be posted to Sakai throughout the semester.

Course Communication using Piazza

All course communication will use *Piazza* (integrated with Sakai). *Piazza* is a free, interactive site where students, TAs, and instructors can connect, ask and answer questions, and share ideas. When students email the instructor or TA with individual questions, your teaching staff may find themselves answering the same questions repeatedly. When a question is posted on *Piazza*, it only needs to be answered once, and answers are community-edited in Wiki style. Students like knowing that others have the same question, and when it's answered on *Piazza*, it's answered for everybody. There is an option to post questions anonymously to other students if you do not want to be identified (you will always be identifiable to the TAs and instructor). Because both the residential and executive sections will be working through the same material during the same week, the Sakai and *Piazza* sites are integrated. The instructional staff have the ability to limit postings through either site to one section as needed.

Post **all** course-related questions and comments to Piazza. **Students who email the instructional staff directly for anything related to the course will be redirected to Piazza.** If you have a sensitive question (e.g., grade-related), or a question you believe may be restricted (issues during exams), Piazza gives you the option to make your question private for the instructors & TAs only. **All private messages should be sent to “Instructors” rather than an individual instructor or TA so all instructional staff can view the message and have the opportunity to respond.** We will do our best to respond within 24 hours (weekdays) and within 48 hours (weekends and holiday breaks) to items requiring our attention. You may get an answer from another student in the interim, and we can endorse responses once we view them to let you know a thread is on track.

Access the Piazza toolbar in Sakai and sign up for an account with your UNC email address. **Non-UNC email accounts will be removed. Note this site does not use your UNC ONYEN/password combination.** Instead, when prompted to create a password, please choose a password other than your ONYEN password, but that you will easily remember over time. It is *strongly recommended* students sign up for real-time notification (under Settings→Account/Email Settings→Edit Email Notifications) to ensure they receive prompt notification for all class communication.

Class Structure and Engagement

This class employs an active learning model built upon an equal partnership between the instructional staff and students. The instructional staff is responsible for delivering the course material in a consistent and engaging manner that challenges students while allowing for different backgrounds and learning styles. Students are responsible for, and participate fully, in their own learning. Rather than passively absorbing information, students take an active role in class: discussing concepts, evaluating how and why things are done a certain way, working problems, and putting lessons into a larger context. Students are expected to come to class prepared for that day's material, ready to engage with the instructional staff, their groups, and the larger class, and may be actively brought into the discussion at any time. While attendance is not mandatory, it will be noted throughout each class and is strongly recommended to succeed in this course. Excessive absences, and a pattern of late arrival/leaving early signals a lack of engagement to the instructor, TAs, and groups. As such, the extent to which one attends, fully prepares for, and actively engages in class throughout the semester may impact a student's overall course grade (see Evaluation Methods).

A note about class distractions: Things like electronics, email, and social media have become a necessary part of life for many people (including this class), yet they can detract from the learning environment and signal disengagement to the instructor and other students when used inappropriately during class. **Please refrain from non-class-related activity during class time.** Urgent situations arise; if you need to tend to something that cannot wait until class has ended, please remove yourself from class (let your group know if needed) and return when you are finished to be respectful to your fellow classmates and the instructional staff.

Evaluation Methods

Individual vs. Collaborative Assessment

We all have different strengths and limitations. Some students are stronger quantitatively and technologically; others struggle more with the concepts and skills taught in this course. In the "real world", we often work with colleagues among whom strengths are balanced and the group is stronger as a result, yet we are ultimately responsible for our own work and are assessed based on individual contributions and performance. This course provides for team-based learning, but assesses

students at the individual level only. Students will be placed into collaborative learning groups to work together throughout the semester. The goal is for students to build individual skills and knowledge by working in a supportive and collaborative environment. To facilitate this, students are assessed on their individual level of understanding before and after a module is taught via online assessments. During each module, students have the opportunity to learn from each other by working through in-class and homework activities in their collaborative learning group. Students who are weaker in quantitative methods and/or Excel can benefit from having problems clarified by group members who better understand the material being covered, while those for whom the material comes more easily can confirm their understanding by explaining it to others.

Grade Components

Component	% of Final Course Grade
Readiness Quizzes (RQs) ¹	15
Homework Activities (HW) ^{1,2}	15
Module Review Tests (MRTs; 5 equally weighted)	50
Final Project (Paper & Presentation)	20

1. Barring true emergencies (to which University policy applies), deviations from the posted due dates will not be granted for deliverables due to travel, illness, or other circumstances. For this reason, I strongly encourage students to be thoughtful about using the dropped RQ and HW Activity. If all work is complete, Sakai will automatically drop the lowest grades from these components. No other deliverables will be dropped from the final grade calculation.
2. In order to receive a passing grade in the course (P or higher), grades on your individual work (i.e., RQs, MRTs and Final Project) must average 75% or greater. In other words, your HW (as it is collaborative) cannot pull you up from a grade of L or F earned across those three individual grade components.

Evaluation Criteria

Readiness quizzes (RQs) assess familiarity with topics and terminology, and general understanding of the upcoming class material. Quizzes are open-book/open-note, timed, brief (typically 10 questions to be completed in 20 minutes), in various formats (e.g., multiple choice, true/false, short answer, etc.), accessed via Sakai, and available for several days before class. Unless otherwise noted in Sakai and/or the course schedule, RQs are due by 11:59pm ET the **Monday** of the week material is covered and cannot be made up for **any** reason—missed quizzes will receive a grade of 0. Students are responsible for ensuring a reliable internet connection, following Sakai best practices for online assessment (<http://blog.teachingandlearning.unc.edu/2012/04/12/5-things-students-need-to-know-about-online-testing-in-sakai/>), and allowing enough time to complete each quiz in the allotted timeframe. The lowest quiz score will be dropped in calculating the final course grade. Note, if you miss a quiz, you will not have access to the quiz questions unless you get them through a classmate. *Readiness quizzes are individual work and the UNC Honor Code is in effect.*

Homework (HW) Activities provide an opportunity to apply and discuss material covered through the pre-class preparation and class sessions, seek out clarification on any sticking points, and self-evaluate knowledge and understanding. They are designed to apply relevant concepts from class shortly after the relevant class session, and are evaluated on timeliness and completion only. Students are not only allowed, but **encouraged** to work through activities within their groups to facilitate learning, but are responsible for knowing the material individually for exams. Whenever possible, a small portion of class time will be granted to work on homework activities within groups. HWs are due on Sakai by 11:59pm ET the **Thursday** following the week assigned (see Course Schedule) and cannot be made up for any reason. HWs will only be accepted on Sakai (not via email/Piazza). Students are responsible for ensuring a reliable internet connection and allowing

enough time to complete and submit each homework activity. The lowest homework activity grade will be dropped in calculating the final course grade. **Although students are encouraged to work in their groups, activities are graded at the individual level and each student is required to submit an individual assignment to receive credit.**

Grading scale for Homework Activities

Criteria	Score
▪ Assignment is completed on time (all questions completed and all work shown)	5
▪ Assignment is on time and incomplete (all questions attempted, but any problem/section incomplete, or any portion of work not shown)	3
▪ Assignment was not submitted by the due date, or all problems are not attempted	0

Grading of activities will employ a 0-5 scale (above) based on successful completion and submission by the posted due date. **Note, HW grades will be based on whether or not a good faith attempt was made for all problems.** Learning from mistakes best occurs when a student is able to not only view the correct answer, but see how it was achieved and how deviations from the correct response may have occurred. For this reason, students should review their individual homework activities when the solution is available to identify opportunities for improving problem solving and understanding. We will post an annotated key and brief video for each homework activity on Sakai to clarify and explain problem set-up, analysis, and interpretation (where applicable). Students should compare their assignments to the key/video first and bring additional questions to the attention of the TA and/or instructor via Piazza or office hours. **Note that in order to receive a passing grade in the course (P or higher), grades on your individual work (i.e., RQs, MRTs and Final Project) must average 75% or greater. In other words, your HW (as it is collaborative) cannot pull you up from a below-passing grade (L or F) earned across those three individual grade components.**

Late Activity Policy: **Homework activities received after the due date will not be graded and the student will not receive credit.** Note that assignments are an opportunity to practice the material without being graded on correctness. For this reason, it is always in the student's best interest to fully attempt all problems and submit the activity by the due date. Students in need of extensions due to a true emergency (e.g., hospitalization, death of an immediate family member) should contact the instructor and program director as soon as possible, ideally before the due date. University policies are in place to assist students and provide guidance for faculty in such circumstances.

Module Review Tests (MRTs) assess individual mastery of module concepts and skills covered through the pre-class material, class sessions, and activities. MRTs are open-book/open-note, timed, available on Sakai shortly after a given module has concluded, and will contain questions in various formats (e.g., multiple choice, short answer, problem solving). As with RQs, ensuring a reliable internet connection, adherence to Sakai best practices for exam-taking (<http://blog.teachingandlearning.unc.edu/2012/04/12/5-things-students-need-to-know-about-online-testing-in-sakai/>), and adequate time to complete the MRT is each student's full responsibility. Exceptions to time limits and other policies will not be granted for technical issues students encounter during assessments unless a Sakai error occurred as determined by the SPH Sakai administrator. Students will have one week following posting of MRT grades/answers to request review of a question by the instructor via Piazza. Exams will not be reviewed after this time. Any and all current class materials may be used during the MRT, but students may not discuss the exam with others. *MRTs are individual work and the UNC Honor Code is in effect.*

The **Final Project** is a culmination of material learned throughout the semester and provides students 1) an opportunity to select a healthcare, health policy, or public health problem of personal interest; 2) a chance to demonstrate application of the appropriate operations research methodology to solve the problem; and 3) a means to present their process and findings professionally and succinctly in both written and oral form. The final project comprises a brief paper and short class presentation, and must be completed individually. **Further details, as well as grading rubrics for both the written and oral components of the final project, will be provided via Sakai later in the semester.**

Class Attendance and Engagement: We expect that students will come to every class prepared, participate fully in class as individuals and in groups, and foster an environment of respect, collegiality, and learning (see *Class Structure and Engagement*). Students who miss 3 or more weeks of class for **any** reason other than true, documented emergencies as recognized by the University, or who demonstrate a pattern of arriving late to or leaving early from class, will receive a 5% deduction in their final course grade. In addition, students who miss **any** portion of class sessions during the final project presentations for **any** reason other than a true, documented emergency as recognized by the University will have deductions applied to their final project grade. This will be detailed in the grading rubric for the final project.

Using Sakai to Stay on Track

The weekly plan for the semester, including reading assignments, homework activities, and any assessments, is included in the Course Schedule. A more detailed plan for each week will be available on Sakai for a given module. Students should use the Course Schedule as a general guide, but review the specific topic on Sakai to ensure they complete all required components on time, download and review any class activities before class begins, and have access to supplemental materials if needed. As noted in the footer of this document, any necessary changes to the schedule will be announced (via Piazza) and a revised document posted to Sakai.

Please note that the submission time for all deliverables is determined by Sakai's internal clock rather than the clock on the student's computer or any other source. For this reason, it is highly recommended that students submit all materials early in order to avoid missing the cutoff.

Grading Scale

Students earn their final course grades based on the following grading scale (please see <http://handbook.unc.edu/grading.html> for information about UNC Graduate School grading):

92 or above	H	(High Pass – Clear Excellence)
75 to 91.9	P	(Pass – Entirely Satisfactory Graduate Work)
60 to 74.9	L	(Low Pass – Inadequate Graduate Work)
Below 60	F	(Fail)

Final grades earned by students are not rounded up (e.g., a 91.9 is a P). Students who do not submit at least 50% of the course deliverables will earn a grade of F unless they withdraw from the course before the withdrawal period ends. Please read your program policies regarding grading and withdrawal, or speak to your program registrar and be aware of the withdrawal period. **Also, as noted under Grade Components, grades on your individual work (i.e., RQs, MRTs and Final Project) must average 75% or greater in order to receive a passing grade (P or higher) in the course.**

Guidelines on Use of Laptops and Other Electronics in Classroom

As mentioned above (see Computer and Software Requirements), a computer is required, and will be used in class sessions to work through problems. For this reason, students should have a computer available for all sessions (configured for eduroam UNC network access when used on campus). Guidelines for setting up wireless access can be found through the UNC IT web site (<http://help.unc.edu/help/connecting-to-the-unc-network-getting-started/>). Students should refrain from using any other electronics during class (see Class Structure and Engagement).

Recognizing, Valuing, and Encouraging Diversity

The importance of diversity is recognized in the HPM mission statement. In the classroom, diversity strengthens the products, enriches the learning, and broadens the perspectives of all in the class. Diversity requires an atmosphere of inclusion and tolerance, which oftentimes challenges our own closely-held ideas, as well as our personal comfort zones. The results, however, create a sense of community and promote excellence in the learning environment. **This class will follow principles of inclusion, respect, tolerance, and acceptance that support the values of diversity.**

Diversity includes consideration of: (1) life experiences, including type, variety, uniqueness, duration, personal values, political viewpoints, and intensity; and (2) factors related to “diversity of presence,” including, among others, age, economic circumstances, ethnic identification, family educational attainment, disability, gender, geographic origin, maturity, race, religion, sexual orientation, social position, and veteran status.

Disability Accommodation

UNC-CH supports all reasonable accommodations, including resources and services, for students with disabilities, chronic medical conditions, a temporary disability, or a pregnancy complication resulting in difficulties with accessing learning opportunities.

All accommodations are coordinated through the UNC Office of Accessibility Resources & Services (ARS), <http://accessibility.unc.edu>, phone 919-962-8300, or email accessibility@unc.edu. Students must document/register their need for accommodations with ARS before any accommodations can be implemented.

Other Assistance and Support

Students may find themselves facing personal or mental health difficulties during the course of their studies for which they need additional and/or professional assistance. The University offers support and resources to students in such times of need. Counseling and Psychological Services (CAPS) is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: <https://caps.unc.edu> or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more.

UNC Honor Code

The principles of academic honesty, integrity, and responsible citizenship govern the performance of all academic work and student conduct at the University as they have during the long life of this institution. Your acceptance of enrollment in the University presupposes a commitment to the principles embodied in the Code of Student Conduct and a respect for this most significant Carolina tradition. Your reward is in the practice of these principles.

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Your participation in this course comes with the expectation that your work will be completed in full observance of the Honor Code. Academic dishonesty in any form is unacceptable; any breach in academic integrity, however small, strikes destructively at the University's life and work.

For in-class problems, activities, and in studying for exams, you are encouraged to get help from your group, Piazza, or the TA or instructor as needed. However, on individual Readiness Quizzes (RQs), and Module Review Tests (MRTs), and the Final Projects, students are not to receive help from other members of the class or from any other individual. **For all work in this course to which the Honor Code pledge is required (i.e., quizzes and exams), consulting or submitting work of prior students is strictly prohibited and will be considered a violation of the Honor Code.** If you need help, work with your group or other classmates, ask questions on Piazza, or consult with the TA during office hours or the instructor outside of class. The instructional staff is also available to help students determine strategies to help them work smarter (vs. harder) in order to be successful in completing course material.

In this course, students are permitted full access to class resources from the current semester and a great deal of flexibility in completing deliverables to which the Honor Code applies (i.e., RQs and exams). Any suspected instances of Honor Code violations in this course will be addressed swiftly and in full accordance with University policies, i.e., reported immediately to the Office of Student Conduct.

In addition to the items mentioned above, sharing of any materials from this course in any non-UNC domain or on any website other than UNC password-protected sites without the expressed written consent of the instructor is strictly prohibited and will be considered an Honor Code violation.

If you have any questions about your responsibility or the responsibility of faculty members under the Honor Code, please consult with someone in either the Office of the Student Attorney General (966-4084) or the Office of the Dean of Students (966-4042). You may also read "The Instrument of Student Judicial Governance" (<http://instrument.unc.edu>) for additional information.

Course Evaluation

HPM participates in the UNC-CH's online course evaluation system, enabled at the end of the semester. Your responses will be anonymous, with feedback provided in the aggregate. Open-ended comments will be shared with instructors, but not identified with individual students. Your participation in course evaluation is an expectation, since providing constructive feedback is a professional obligation. Feedback is critical, moreover, to improving the quality of our courses, as well as for instructor assessment. Students are notified when the evaluation is available online, towards the end of each semester.

Helpful Links

Video links may be posted to Sakai throughout the semester to facilitate and supplement learning for both Excel, and statistical concepts and skills. The following resources may also be of use during the semester:

Excel Resources and Refreshers

<https://www.amazon.com/Excel-2016-Bible-John-Walkenbach/dp/1119067510> (Excel Bible)

<http://www.dummies.com/store/product/Excel-2016-All-in-One-For-Dummies.productCd-111907715X.html> (Excel for Dummies)

<http://software.sites.unc.edu/lynda/> (e-Learning through Lynda.com)

<http://software.sites.unc.edu/it-academy/> (e-Learning through Microsoft Academy—see *Academic Office 2013 Library*)

<https://www.youtube.com/> (a plethora of videos on Excel tools and tips)

Introductory Statistics Video Series (various, by topic)

<http://www.learner.org/courses/againstallodds/unitpages/index.html>

https://www.youtube.com/channel/UCID8c_piy1nrJySPJUgyivg

<https://www.youtube.com/channel/UCG32MfGLit1pcqCRXyy9cAg>

UNC Virtual Lab

<http://help.unc.edu/help/what-is-virtual-lab/> UNC Virtual Lab—Overview & links to instructions for use