COURSE OUTLINE (Tentative)

BUSADMIN C755
Analytics and Decision-Making in Healthcare
(Winter 2023)

Health Policy & Management Area
DeGroote School of Business
McMaster University

COURSE OBJECTIVE

The need for healthcare analytics and its links with decision-making is growing rapidly. The goal of this course is to walk the student through an important journey: from data analytics (using Machine Learning (ML) to decision-making (using decision analysis, simulation, and optimization techniques). In doing so, it teaches how to use analytical modelling with various types of healthcare data (such as Electronic Health Records (EHR) and public health data) and to understand healthcare systems and predict healthcare outcomes as well as clinical and public health interventions toward making informed, optimal decisions. This analytics paradigm is to transform healthcare delivery for individuals and populations. Therefore, it explores the role of ML in supporting data-driven decision-making in healthcare systems. To this end, the course equips the students with analytical thinking and problem-solving mindset for a wide range of purposes/applications, including descriptive, predictive, and prescriptive analytics. Using numerous healthcare applications, various techniques for healthcare data analytics and decision analysis are lectured. This course covers topics such as descriptive analytics using data visualization, predictive analytics using regression and classification, and prescriptive analytics using decision trees, simulation, and basic linear programming using R programming and other tools.

INSTRUCTORS/TA'S AND CONTACT INFORMATION

Instructor:	**TA:**
Dr. Manaf Zargoush	**TBD**
Health Policy & Management Area	
Email: zargoush@mcmaster.ca	
Page: https://experts.mcmaster.ca/display/zargousa	
Office Hours: by appointment	

Class Schedule: Mondays 7–10 pm

COURSE ELEMENTS

Avenue:	Yes	Leadership:	No	IT skills:	Yes	Global view:	Yes
Participation:	Yes	Ethics:	Yes	Numeracy:	Yes	Written skills:	Yes
Evidence-based:	Yes	Innovation:	Yes	Group work:	Yes	Oral skills:	Yes
Experiential:	Yes	Guest speaker(s):	Yes	Final exam:	No		

COURSE DESCRIPTION

This course provides the students with an introduction to essential analytical methods for analyzing complex healthcare decisions at the tactical, operational, and strategic levels. Various methods spanning data-driven ML techniques (when data is available) and model-driven (when data is unavailable) will be introduced using the commonly-used analytical tools in R and Excel. Different methods of descriptive analytics (e.g., data visualization), predictive analytics (e.g., classification and regression), and prescriptive analytics (e.g., simulation, decision trees, and basic linear programming) will be used to analyze healthcare problems under uncertainty and certainty. These tools together will present methods for incorporating the various, and sometimes conflicting, aspects of healthcare, such as personal, social, political, economic, and global criteria, when analyzing healthcare problems and making health-related decisions. The course, therefore, brings the multidisciplinary perspective into the broad context of healthcare decision-making. The methods will be presented using real applications in healthcare, including clinical diagnosis and prognosis, patients' response to treatments, waiting time, process management, as well as clinical and public health interventions. The course is suitable for all graduate students in the Health Services Management MBA, Public Health, eHealth, Health Policy, and all other students who are interested in learning the existing analytical tools (such as ML) and "analytical thinking" that can help healthcare managers, clinicians, and policymakers make complex decisions.

LEARNING OUTCOMES

Upon completion of this course, students will be able to:

- Employ analytical thinking for describing healthcare problems, predicting their outcomes, and improving their results
- Apply data-driven techniques in the presence of data and model-driven techniques in the absence of data
- Explain how analytics can be utilized to improve the quality and efficiency of healthcare deliveries for individuals, populations, and global health
- Describe data analytics techniques and decision analysis practices in healthcare and how they can be useful
- Describe healthcare data visualization principles, healthcare prediction approaches, and healthcare optimization techniques for supporting decision making
- Design analytical strategies to characterize important issues and solutions for improving individual, population, and global health
- Discover meaningful, relevant, and important patterns and trends from healthcare data

COURSE MATERIAL AND READINGS

The course material (chapters, articles, case-studies, tutorials, etc.) will be provided online through the C755 Course site on McMaster's Avenue to Learn system (http://avenue.mcmaster.ca)   *FREE*

Textbooks **(all FREE to access through McMaster Library)**

R for Health Data Science   By Ewen Harrison & Pius Riinu
Free for McMaster students to be downloaded through the following link or searching the title via Mac Library (using Mac VPN):
https://www-taylorfrancis-com.libaccess.lib.mcmaster.ca/books/mono/10.1201/9780367855420/health-data-science-ewen-harrison-pius-riinu

Data Science and Predictive Analytics *(Biomedical and Health Applications using R)*   By Ivo D. Dinov
Free for McMaster students to be downloaded through the following link or searching the title via Mac Library (using Mac VPN):
https://link-springer-com.libaccess.lib.mcmaster.ca/book/10.1007%2F978-3-319-72347-1

Analytics and Decision Support in Health Care Operations Management   By Yaser Ozkan
Free for McMaster students to be downloaded through the following link or searching the title via Mac Library (using Mac VPN):
https://ebookcentral.proquest.com/lib/mcmu/detail.action?docID=4829166

Optional reading regarding some background knowledge about Statistics useful for the course (ch1-5):
Excel 2019 for Health Services Management Statistics *(A Guide to Solving Problems)* By Quirk & Cummings
Free for McMaster students to be downloaded through the following link or searching the title via Mac Library (using Mac VPN):
https://link-springer-com.libaccess.lib.mcmaster.ca/book/10.1007%2F978-3-030-57828-2

Optional reading for **Global Health Students:**
Leveraging Data Science for Global Health   By Leo Anthony Celi et al.
Free for McMaster students to be downloaded through the following link or searching the title via Mac Library (using Mac VPN):
https://link-springer-com.libaccess.lib.mcmaster.ca/book/10.1007%2F978-3-030-47994-7

CLASS FORMAT AND SCHEDULE

In-Class (On-Campus)

- The in-class sessions may include any combination of lectures, guest speakers, group discussions, computer labs, or other content.
- Additional content (readings, videos, etc.) may be posted on the A2L site throughout the term.
- Students are expected to complete all required readings and submit the assignments prior to attending class each week.
- Students may not make audio and/or video recordings of any portion of a class without the written permission of one of the instructors.
- All students are expected to attend and participate during student presentations.

Online (through A2L)

The online classes, referred to as "*analytics bootcamp weeks*," occur in particular weeks according to the course schedule available on A2L.

EVALUATION

Learning in this course comes from readings, lectures, case studies, in-class and online discussion and participation, completion of assignments, and presentations. All work will be evaluated on an individual basis except where group work is expected. In these situations, group members will share the same grade unless group members agree to an adjustment. Peer evaluation might also be used to assess the member's contributions to their own group. Online lectures (i.e., analytics bootcamps) will be facilitated through the Avenue to Learn (A2L) platform. Students are expected to be adult learners who will independently read course content posted on the A2L course website, analyze information, and share their new knowledge and understanding with their classmates (in-class and online) so that they learn from each other as well as from the instructor. Students will use course content posted on A2L and the textbook, along with additional readings, videos, or websites as identified throughout the course. For online components of the course, students will complete and post assignments and/or interact with other students through A2L.

Communication and Feedback

Students who wish to correspond with the instructor directly via email must send messages that originate from their official McMaster University email account. This protects the confidentiality and sensitivity of information as well as confirms the identity of the student.

Instructors should conduct an informal course review with students by Week #4 to allow time for modifications in curriculum delivery. Instructors should provide evaluation feedback for at least 10% of the final grade to students prior to Week #8 in the term.

Conversion

At the end of the course, your overall percentage grade will be converted to your letter grade in accordance with the following conversion scheme.

LETTER GRADE	PERCENT	LETTER GRADE	PERCENT
A+	90 - 100	B+	75 - 79
A	85 - 89	B	70 – 74
A-	80 - 84	B-	60 - 69
		F	00 - 59

Components and Weights

Participation	15%
Weekly Assignments (during in-person weeks)	20%
Bootcamp Weeks Discussions (during online weeks)	30%
Final Project: • **Presentation** (during last two weeks) • **Report** (due date: TBD)	35%

Assignments & Participation

Name cards and photographs are used to help give credit for your participation. You must have a name card with your **full first and last name** clearly written and displayed in front of you for every in-class session. **Students are expected to post their photographs on the Avenue to Learn system during the first week of class.** The instructor will feel free to cold-call anyone at any time. Hence, it is imperative that you prepare for each and every case and reading. Participation will **NOT** be graded by counting each contribution a student makes. Participation will be graded by examining the **quality** of contributions each week.

When individual or group assignments are required to be submitted, students should do so by midnight (EST) of the due date. All assignments are to be submitted as Word or PDF documents. Please note that should there be any problems with the A2L site that limits students' ability to participate in discussions or submit assignments, all deadline times/dates will be extended.

All submissions (presentation slides, summary reports, and evaluations) must be made through the A2L designated for the assignment of the interest.

Discussion Questions During Analytics Bootcamp Weeks (Asynchronous via A2L)

Students are expected to post at least one main response to each online discussion question. In addition, you are expected to participate in the overall online discussion by commenting on other students' posts (at least two times per online week).

Postings should be concise, reflective, and respectful. Students are expected to share ideas and experiences related to the topics presented during online discussions. Make sure you are adding value and not simply repeating what others have already said. **Please note that the evaluation of your online participation will be based on the quality of your overall contribution**.

At the discretion of the instructor, students may also be assigned one week during which they will be responsible for facilitating discussion (getting things started early in the discussion period and intervening when necessary) and/or for summarizing the main discussion points at the end of the week (keeping the summary brief and posting it prior to the closing of the discussion time window). The course instructor and/or TA will limit their participation so as not to overly influence the direction of the discussion. During the online weeks, you will only have access to your discussion group.

There is also a General Discussion area where students may interact with each other. The instructor/TA will not be monitoring this area routinely, so if you have an important question, please email the instructor/TA directly using McMaster email.

The end of term presentations will be evaluated for

1. Completeness and correctness of the analytical techniques/modeling,
2. Innovation in analytical thinking,
3. Managerial/policy insights,
4. Ability to facilitate discussions.

Groups will be assigned a date for their presentation. The presentation slides are to be submitted no later than midnight on the day of the presentation.

ACADEMIC DISHONESTY

It is the student's responsibility to understand what constitutes academic dishonesty. Please refer to the University Senate Academic Integrity Policy at the following URL:

http://www.mcmaster.ca/univsec/policy/AcademicIntegrity.pdf

This policy describes the responsibilities, procedures, and guidelines for students and faculty should a case of academic dishonesty arise. Academic dishonesty is defined as to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. Please refer to the policy for a list of examples. The policy also provides faculty with procedures to follow in cases of academic dishonesty, as well as general guidelines for penalties. For further information related to the policy, please refer to the Office of Academic Integrity at:

http://www.mcmaster.ca/academicintegrity

In this course, we will be using a web-based service (Turnitin.com) to reveal plagiarism. Students will be expected to submit their work electronically. Students who do not wish to have their work assessed through Turnitin.com must advise their instructor(s) in writing. No penalty will be assigned to a student who does not wish to have their work assessed through Turnitin.com. However, all submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., online search, etc.). To see the Turnitin.com Policy, please go to:

https://www.mcmaster.ca/academicintegrity/

USE OF AVENUE TO LEARN SYSTEM

In this course, we will be using Avenue to Learn. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, usernames for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

Students should avoid using the Avenue email system and instead use your McMaster email accounts for communicating with the instructor or TA.

STUDENT ACCESSIBILITY SERVICES

Student Accessibility Services (SAS) offers various support services for students with disabilities. Students are required to inform SAS of accommodation needs for coursework at the outset of the term. Students must forward a copy of such SAS accommodation to the instructor normally within the first three (3) weeks of classes by setting up an appointment with the instructor. If a student with a disability chooses NOT to take advantage of a SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. The SAS website is: http://sas.mcmaster.ca

POTENTIAL MODIFICATIONS TO THE COURSE

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with an explanation and the opportunity to comment on changes. **It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.**