Course Syllabus

Course Information

Course Number/Section	HMGT 6334/MIS 6305
Course Title	Healthcare Analytics
Term	Fall 2023
Meetings	Wednesdays 7 PM

Professor Contact Information

Professor	Mehmet U.S. Ayvaci
Office Phone	972-883-4747
Email Address	mehmet.ayvaci@utdallas.edu
Office Location	JSOM 3.202
Office Hours	By email
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TA Office Hours	By email

Course Modality and Expectations

Course Platform	This class is taught in the classroom.
Expectations	(1) Students can attend class in person. (2) Students can use the class time to interact with the instructor real time. (3) There is no class attendance requirement for lectures, but attendance can help in boosting grades through extra credit. (4) Instructor will post discussions on a regular basis, using eLearning tools. Student involvement in these discussions accounts towards participation (which boosts your grade and ensures engagement).
Learning Guidelines	All lecture material will be available for all students (lecture will not be recorded You need to follow along at the pace of the class whether you attend the class or not.

Course Pre-requisites, Co-requisites, and/or Other Restrictions
OPRE 6301 or SYSM 6303 (Co-requisite).

This course is an approved elective for the M.S. degree in Healthcare Management and for the Healthcare Analytics track in the M.S. degree in Business Analytics. It is also an elective course for the M.S. degree in Information Technology Management (Healthcare Systems Track) and the MBA degree (Healthcare Concentration). The course is ideally suited to students who wish to focus on careers in the healthcare industry, as health IT analysts, policy analysts, managers or administrative staff, or healthcare consultants, who wish to develop a better understanding of healthcare analytics.

Healthcare Certificate Program Requirements
A qualifying grade in this class fulfills one of the requirements to receive an Academic Certificate in Healthcare Information Technology from UTD. For more information or to apply for admission to the certificate program, please go to https://osim.utdallas.edu/program-resources/healthcare-certificates/healthcare-it/

Course Description

The purpose of this course is to introduce the use of business intelligence and decision analytics for health-care problems. As the pressures of managed care and increasing health care costs push providers, payers and purchasers of health care to become more efficient, methods for understanding the appropriate basis for how to allocate shrinking health care resources must be understood. Moreover, the health care industry is yet to find ways to make best use of existing data to improve care, reduce costs, and provide more accessible care. In addition to developing a conceptual understanding of business intelligence and predictive analytics, the course will develop some technical skills in prescriptive analytics using decision analysis and cost effectiveness. The course will include hands-on experience with R using RStudio. Examples from the health care practice and managerial decision making will be discussed.

Major topics in this course include:

- Foundations of healthcare analytics
- Healthcare delivery in the US and data creation process
- Medical decision making and Machine Learning Foundations
- R programming
- Measuring healthcare quality and value
- Data mining for improving health outcomes and reducing costs
- Predictive models in healthcare and clinical decision support
- Data-driven decision making in healthcare
- Cost-effectiveness analysis for medical decisions
- Future of healthcare analytics

Student Learning Objectives and Outcomes

1. Students will demonstrate applications of data analytics related to healthcare information to develop decisions and healthcare management strategies.
2. Students will demonstrate know-how of how to extract and apply business intelligence techniques to improve decision making using healthcare data.

CAHME Competency Model Mapping

Domain 2: Leadership

- Critically analyze organizational issues after a review of the evidence. (SLO1)

Domain 5: Business Knowledge and Skills

- Demonstrate an ability to analyze and evaluate information to support a decision or recommendation (SLO 1)
- Show the ability to critically think and analyze data (SLO 2)
- Demonstrate an understanding of using analytics software to draw conclusions (SLO 2)

Mandatory Text:

Burke, J. (2013). *Health analytics: gaining the insights to transform health care* (Vol. 71). John Wiley & Sons. (Available Online UTD Library)

Viswanathan, V. (2014). *Data Analytics with R: A Hands-on Approach*. Infivista Incorporated.

Recommended Text:

Data Mining with Rattle and R by Graham Williams, 2011, Springer Publishing. ISBN 978-1-4419-9890-3. (Available online at the library webpage)

Clinical Prediction Models: A Practical Approach to Development, Validation, and Updating by Ewout W. Steyerberg, 2010, Springer Publishing. ISBN 978-1-4419-2648-7. (Available online at the library)

Healthcare Analytics for Quality and Performance Improvement by Trevor L. Strome, 2013, Wiley Publishing, ISBN: 978-1-118-51969-1

Methods for Evaluation of Health Care Programmes, Second Edition by Drummond MF, O'Brien B, Stoddart GL, Torrance GW, Oxford Medical Publications, Oxford 1997.

Required Software:
R software and Rattle add on. These are free software available for download and installation at Open Source R Software: http://cran.r-project.org/ Please make sure you have downloaded R and RStudio in your machine before attending. You can follow the step-by-step instructions from the above link or this link: https://www.earthdatascience.org/courses/earth-analytics/document-your-science/setup-r-rstudio/ Depending on your operating system of your machine, please refer to the sections in the webpage. At some point in the class, I will also introduce Rattle, an R add-on, which can be found at http://rattle.togaware.com/

Mandatory Readings: The instructor will supplement the text with other relevant course materials as needed including but not limited to executive interviews, case studies, scholarly journal articles, newspaper articles, magazine articles, and other relevant information. Visit eLearning for all course-related information including syllabus, lecture notes, self-quizzes, and assigned discussion problems.

Textbooks and some other bookstore materials can be ordered online through Off-Campus Books or the UTD Bookstore. They are also available in stock at both bookstores.

Suggested Course Materials
Suggested Readings/Texts
The instructor will supplement course materials with other readings via email or web links. No need for purchase.
Suggested Materials
None
Textbooks and some other bookstore materials can be ordered online or purchased at the UT Dallas Bookstore.

Academic Calendar

MODULE/ DATES	TOPIC	ASSIGNED READINGS	ASSESSMENT/ ACTIVITY	DUE DATE
I Aug 23	**Foundations of Healthcare Analytics** • Definitions • Brief history • Types of Analytics • Examples	• Lecture Notes • Chapters 1-3 (Burke)		

II Aug 30	**An Introduction to R using RStudio**	• Lecture Notes • Pg 5-64 (Viswanathan)		
III Sept 6	**Data creation process in Healthcare** • Patient data • Standards in healthcare • R practice with health data	• Lecture Notes • Chapter 4 (Burke)	Assignment 1	Due Sept 10 11 PM
IV Sept 13	**Healthcare delivery in the US and data creation process** • Healthcare financing and policy • Defining Value • Outcomes and Costs	• Lecture Notes • Chapter 6, 7, 8 (Burke)	Quiz 1 offered in eLearning	Available Sept 15-16 (9 AM-11PM)
V Sept 20	**Medical decision making and Machine Learning Foundations** • What is data analytics? • Data Retrieval, Manipulation, Preparation • Exploratory data analysis using • Preprocessing in R	• Lecture Notes • Pg 83-110 (Viswanathan)	Assignment 2 (Also Case 1)	Due Sept 24 11PM
VI Sept 27	**Descriptive Models in Healthcare** • Visualization • Good vs. Bad Dashboards • Affinity Analysis	• Lecture Notes • Pg 65-82 (Viswanathan) • Pg 295-306 (Viswanathan)	**(A)** Quiz 2 offered in eLearning **(B)** Project Ideas	**(A)** Available Sept 29-Sep 30 (9 AM-11PM) **(B)** Due Sept 28 11PM
VII Oct 4	**Statistics for Analytics** • Basic Stats • Regression Methods for Predictive Analytics	• Lecture Notes • Pg 232-272 (Viswanathan)		
VIII Oct 11	**Predictive Models in Healthcare** • Classification • Decision Trees • Evaluating Performance	• Lecture Notes • Pg 111-116 (Viswanathan) • Pg 155-206 (Viswanathan)	Assignment 3 (Also Case 2)	Due Oct 15 11 PM
IX Oct 18	**End-to-end Model Building Using R** • Logistic regression • KNNs (if time permits)	• Lecture Notes • Pg 155-206 (Viswanathan)	**(A):** Project Proposals **(B):** Quiz 3 offered in eLearning	**(A):** Due Oct 22 (11 PM) **(B):** Available Oct 20-21

				(9 AM-11PM)
X Oct 25	**Reduction Techniques** • Clustering **Guest Lecture**	• Lecture Notes • Pg 325-345 (Viswanathan)		
Nov 1	**EXAM (Testing Center)** • **Offered in testing center.** • **Book your spots latest 48 hours prior to exam** • **You can bring ONE page 8.5 x 11 Double-Sided Handwritten Notes to the exam**			Nov 1 8:30AM-9PM
XI Nov 8	**Prescriptive Analytics** • Decision Analysis	• Lecture Notes	Quiz 4 offered in eLearning	Available Nov 10-11 (9 AM-11PM)
XII Nov 15	**Cost-effectiveness** • Types of cost studies • Basics of cost-effectiveness • Graphical method		Assignment 4 (Also Case 3)	Due Nov 19 11PM
Nov 20-24	**FALL BREAK AND THANKSGIVING**			
XIII Nov 29	**Project meetings**	Each group will meet the professor during the week		
XIV Dec 6	**Project presentations**		In-class Presentation Due/ Reports Due	Dec 6/Dec 10

Student Assessments

Grading: Course grades will be based on the following components:

Quizzes (20%): You will be given four **timed** quizzes (assigned **individually**) throughout the course of the semester. Each quiz will be available only during the specific date (after 9AM) indicated on the academic calendar, and is due by the end of the day (by 11PM) indicated in elearning (on the day shown in the academic calendar). Each has about 10-15 questions to be completed within 10-15 minutes. Each will have a weight of 5%. Quizzes are NON-CUMULATIVE, you will be responsible for lectures since the last quiz. You may begin a quiz any time during the availability window, however, once 'opened' you will have only the

allotted time to complete. The quizzes are open notes. One question will be presented at a time and you will NOT be allowed to backtrack questions (this is not subject to change, so please do not ask for backtracking to be allowed)! PLEASE PLAN YOUR TIME WISELY. Please read the on-screen instructions carefully before you click begin. Reserve a time when you will not be disturbed. Also have all material (e.g. text, notes, lecture slides) ready before accessing the quiz. Don't waste valuable time "getting organized" after you have accessed the quiz/exam. Because questions are presented one by one and no backtracking allowed, you will need to be prepared even though quizzes are open notes. If you have studied the subject material, the allotted time will be more than enough. If you haven't studied the subject material, you will not be able to navigate your notes in the given time. All quizzes must be submitted via eLearning. Any work sent via email will not be accepted.

Course Project (30%): The class will be split into groups. Each group will be responsible for selecting a project on applying analytics to a healthcare problem, presenting their findings to the class, and submitting a final report. There will be milestones for the project progress and groups will present their progress as indicated in the course schedule. The project may pertain to any topic related to healthcare where analytics techniques are applied using data. Students may choose to work on a real-life problem, possibly collaborating with a healthcare organization, or acquire data from publicly available resources and identify a research problem. The instructor must approve the project that is selected for analysis before the group can proceed with developing the analysis. "We couldn't find a project to work on" or "we could not find data" will not be accepted as an excuse for delays in project progress. Group members will evaluate each other at the end of the semester. It is at the Professor's discretion to how these evaluations will be used in case there is a strong negative evaluation on a group member.

Exam (30%): There will be a timed multiple-choice exam (as shown on the academic calendar). The exam is proctored, and you should take it at the UTD Testing Center. If your circumstances require that you need to take the exam at another approved proctoring center, you should consult with the instructor at the beginning of the semester.[1] The exam will cover course material (text, lecture notes, and readings) taught prior to exam date. The Mid-term exam should be done individually. Exam will be CUMULATIVE and will cover course material (textbook chapters, lecture notes, and readings) taught prior to it. You may expect about 50-60 questions to be done within 50-60 minutes (subject to change). Unlike quizzes, backtracking will be allowed. All exams should be taken during the Testing Center hours **(8:30am to 9:00pm**). Please be sure to see and follow the **Student Guidelines** found on the Testing Center main page. All students are required to make a reservation using the **Reserve Your Seat** application found on the Testing Center main page, at the latest, 48 hours prior to exam. I will make an announcement to you when the Testing Center will be ready to take your reservations. The UTD Testing Center is located in Synergy Park North 2 building (SP2),

[1] If you need to take the exam at an off-campus testing center, you need to check with the instructor at the **beginning** of the semester, during the first 2 weeks, to have permission. After receiving permission students then need to locate an approved Testing Center. **ALL** proctored exam applications must be submitted and received by the UT Dallas Testing Center **at least 15 business days** prior to the exam date. The UT Dallas Testing Center will adhere to the 15-business day deadline submission, **no exceptions**. If you fail to submit your application by the 15-business day deadline, you will need to register for and take the exam at the UTD testing center on the designated date.

Room 11.175. When you arrive to take your exam, you will sign in with your **Comet Card.** You are allowed to bring **ONE page 8.5 x 11 Double-Sided Handwritten** notes to the testing center.

Homework (20%): I will assign four homework assignments throughout the course of the semester. Students are expected to work individually or as a group to complete their homework (individual vs. group assignment will be specified in each assignment). Each HW assignment will count toward 5% of the grade and is due by the date and time indicated in the academic calendar. Three of the assignments will be based on a case (a Harvard Business case may need to be purchased). Assignments **have to be submitted via the eLearning website. Emailed assignments will not be accepted.** Late submissions will be penalized by 20% of the individual homework grade and will not be accepted beyond the 24-hour mark past the due time. It is your responsibility to check the elearning for the assignments. Harvard cases that will be used can be found at: https://hbsp.harvard.edu/import/969952

Cases To be Used for Assignments:

Case 1. Data Analytics at Alexandra Health System: A New Journey in the Healthcare Industry

Case 2. Package Pricing at Mission Hospital

Case 3. Screening for Chronic Kidney Disease

The instructor will decide whether to assign it individually or as groups of two students.

Course Policies

Grading Policy	The following grading policy will be adopted for the class: **A, A-, B+, B, B-, C+, C, C-, P (pass), F (Fail)**. The final letter grade in the class will be based on a curve. Per Jindal policy the average final grade is expected to be around B+ (3.3). However, this average can be high (or lower) based on overall class performance. I will use the plus/minus grading system and details on the plus/minus breakdown will be presented in class. You may expect the following grade distribution: approximately 30-35% will receive an A or A-, about 15-20% a C+ or below, and 45-55% will receive a B+, B, or B-. Note that, this distribution of grades do not depend on the actual grade. For example, a grade of 93 can be the cutoff for grade A or a grade of 85 can be the same cutoff if the class averages are lower. **Hence, the grading is all relative to your peers**. **SHARING QUIZ OR EXAM QUESTIONS WITH OTHERS WILL BE CONSIDERED ACADEMIC DISHONESTY, WHICH WILL TRIGGER THE DUE ACADEMIC PROCEDURES. STUDENTS GIVING AWAY QUESTIONS OR THOSE WHO ARE TAKING QUESTIONS FROM OTHERS WILL RECEIVE A FAILING GRADE. NOTE THAT BECAUSE THE GRADING IS RELATIVE, YOU ARE HURTING YOUR OWN GRADE BY GIVING AWAY QUESTIONS EVEN NOT CAUGHT FOR ACADEMIC DISHONESTY!**
Make-up Exams	NONE
Extra Credit	Instructor will use online in-group discussions and thoughtful participation towards extra credit. Occasionally collected attendance can be counted as extra credit. There may also be 1-2 opportunities for a bonus assignment.
Late Work	See grading for policies.
Special Assignments	NONE
Class Attendance	Assessed through ELearning Discussion Forums. Occasionally, the instructor may collect class attendance and grant bonus points to attending students.
Classroom Citizenship	NA (except through peer evaluations for team work)
Comet Creed	*This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:* *"As a Comet, I pledge honesty, integrity, and service in all that I do."*
Academic Support Resources	*The information contained in the following link lists the University's academic support resources for all students.* *Please go to http://go.utdallas.edu/academic-support-resources.*
UT Dallas Syllabus Policies and Procedures	*The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.* *Please go to http://go.utdallas.edu/syllabus-policies for these policies.*

Class Recordings

Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. If the instructor records any part of the lecture, recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

The instructor may record meetings of this course. Any recordings will be available to all students registered for this class as they are intended to supplement the classroom experience. Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. If the instructor or a UTD school/department/office plans any other uses for the recordings, consent of the students identifiable in the recordings is required prior to such use unless an exception is allowed by law. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Class Participation

Regular class participation (e.g., through online discussions, assignments, projects) is expected regardless of asynchronous access. Students who fail to participate in class regularly are inviting scholastic difficulty. A portion of the grade for this course is directly tied to your participation in this class. It also includes engaging in group or other activities during class that solicit your feedback on homework assignments, readings, or materials covered in the lectures (and/or labs). Class participation is documented by the instructor. Successful participation is defined as consistently adhering to University requirements, as presented in this syllabus. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Class Materials

The instructor may provide class materials that will be made available to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course, however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the Student Code of Conduct.

Technical Requirements
In addition to a confident level of computer and Internet literacy, certain minimum technical requirements must be met to enable a successful learning experience. Please review the important technical requirements on the Getting Started with eLearning webpage.

Course Access and Navigation
This course can be accessed using your UT Dallas NetID account on the eLearning website.

Please see the course access and navigation section of the Getting Started with eLearning webpage for more information.

To become familiar with the eLearning tool, please see the Student eLearning Tutorials webpage.

UT Dallas provides eLearning technical support 24 hours a day, 7 days a week. The eLearning Support Center includes a toll-free telephone number for immediate assistance (1-866-588-3192), email request service, and an online chat service.

Communication
This course utilizes online tools for interaction and communication. Some external communication tools such as regular email and a web conferencing tool may also be used during the semester. For more details, please visit the Student eLearning Tutorials webpage for video demonstrations on eLearning tools.

Student emails and discussion board messages will be answered within 3 working days under normal circumstances.

Distance Learning Student Resources
Online students have access to resources including the McDermott Library, Academic Advising, The Office of Student AccessAbility, and many others. Please see the eLearning Current Students webpage for more information.

Server Unavailability or Other Technical Difficulties
The University is committed to providing a reliable learning management system to all users. However, in the event of any unexpected server outage or any unusual technical difficulty which prevents students from completing a time sensitive assessment activity, the instructor will provide an appropriate accommodation based on the situation. Students should immediately report any problems to the instructor and also contact the online eLearning Help Desk. The instructor and the eLearning Help Desk will work with the student to resolve any issues at the earliest possible time.

COVID-19 Guidelines and Resources
The information contained in the following link lists the University's COVID-19 resources for students and instructors of record.

Please see http://go.utdallas.edu/syllabus-policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.