eHealth 746 Healthcare Analytics
Summer 2026

DeGroote School of Business
McMaster University

COURSE OBJECTIVE: THIS COURSE DESCRIBES HEALTHCARE ANALYTICS PRINCIPLES AND TECHNIQUES FROM THE PRACTITIONER POINT OF VIEW. IT ALSO REVIEWS AND DISCUSSES CRITICAL ISSUES RELATED TO THE RAPIDLY EXPANDING FIELD OF HEALTHCARE ANALYTICS, INCLUDING CASE DISCUSSIONS AND TRAINING IN THE APPLICATIONS OF TOOLS THAT SUPPORT THE USE OF REAL HEALTHCARE DATA IN EFFECTIVE DECISION MAKING.

Thursday 7:00 to 10:00 pm, starting May 7 2026
Dr. Mehrdad Roham
Instructor
rohamm@mcmaster.ca
Office: Microsoft Teams
Office Hours: By appointment
Class Location: Online synchronous

Course Website:	http://avenue.mcmaster.ca

COURSE ELEMENTS

Avenue:	Yes	Leadership:	Yes	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		

Prerequisite: None

Course Description

Healthcare analytics is the systematic use of data and related business insights developed through applied analytical disciplines (statistical, contextual, quantitative, predictive, cognitive, and other models) to drive fact-based decision making for planning, management, measurement and learning in healthcare.

This course aligns with recent progress in analyzing healthcare databases for their knowledge of value for healthcare operations, clinical decision support, and so on. Topics include the integration of operational decision support through sharing of administrative and operational data for multiple independent healthcare providers and across different sectors of care. Students will get hands-on experience with basic and advanced health analytics methods and techniques.

The course will cover basics of raw data reading, data cleaning and management, data analysis, data mining, predictive analytics, social media analytics and data visualization. Students will undertake individual assignments and group projects to learn health analytic principles and techniques: how to ask the right questions, manipulate real health data sets and create a data product to communicate results and to show their analytical skills to potential employers. Students are encouraged to bring their laptops (preferably PCs) to class each day.

LEARNING OUTCOMES

Upon completion of this course, students will be able to complete the following key tasks:

- Explain the role that healthcare analytics can play in the analysis of data to assist in managerial decision making for healthcare institutions and government agencies;
- Assess the prospects of healthcare analytics for playing a significant role in the descriptive, predictive and prescriptive processes in context dependent healthcare environments;
- Define the capabilities needed to successfully develop and deploy a feasible healthcare analytics undertaking for institutional or government agency use;
- Formulate a plan and budget that considers how to modify an organization's capabilities for implementing a healthcare analytics undertaking;
- Understand how to implement data tools for gathering, cleaning, and updating data to be used regularly or on an ad hoc basis to analyze, calculate or predict outcomes for use in decision making.

➢Learn how to present, visualize and interpret findings.

➢Design and develop dashboards for data storytelling.

REQUIRED COURSE MATERIALS AND READINGS

Avenue registration for course content, readings and case materials
- http://avenue.mcmaster.ca

Text (library e-book): Strome, T. L. (2013). Healthcare analytics for quality and performance improvement (e-book). Hoboken, New Jersey, Wiley.

Online access to the McMaster Library to search for journal articles or books relevant to the topics being reviewed in the course.

OPTIONAL COURSE MATERIALS AND READINGS

Books:

- Burke, J. (2013). Health Analytics. Gaining the Insights to Transform Health Care, Wiley.
- Reddy, C. K. and C. C. Aggarwal (2015). Healthcare Data Analytics (pdf Book). Boca Raton, Florida, CRC Press.
- Leiner, F., Gaus, W., Haux, R., & Knaup-Gregori, R..(2003). Medical Data Management: A Practical Guide, Health Informatics Series.
- Siegel, Eric (2013). Predictive Analytics. The Power to Predict Who Will Click, Buy, Lie, Or Die, Wiley.
- Abbot, Dean (2014). Applied Predictive Analytics. Principles and Techniques for the Professional Data Analyst, Wiley.
- Jones, Ben (20140. Communicating Data with Tableau, O'Reilly.
- Miller, James D. (2016). Learning IBM Watson Analytics. Make the most advanced predictive analytical processes easy using Watson Analytics with this easy-to-follow practical guide, PACT Publishing.
- Hawley, David and Raina (2007). Excel Hacks, O'Reilly.

Articles:

- Raghupathi, W. and V. Raghupathi (2014). "Big data analytics in healthcare: Promise and potential." Health Inform Science & Systems 2(3): e10.

- Wang, Y., L. Kung and T. A. Byrd (2018). "Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations." Technological Forecasting & Social Change 126: 3-13.

Online readings:

5 trends in healthcare analytics for 2018

Available at: *https://www.healthdatamanagement.com/list/tableau-software-assesses-coming-changes-in-healthcare-analytics*

The Healthcare Analytics Adoption Model.

Available at: https*://www.healthcatalyst.com/healthcare-analytics-solutions/*

Healthcare Analytics insights.

Available at: *https://www.healthcatalyst.com/knowledge-center/insights/category/analytic-in-healthcare/*

EVALUATION

Student learning is through instructor presentations, discussions of cases relevant to specific topics, practices, assignments, student group presentations, and presentations by visiting speakers. Please see pages 9-13 for more details. From the beginning of the term, students will be organized into groups with a maximum number of three in each group. An attempt will be made to balance technical, healthcare, and business backgrounds and expertise among the members of each group.

Discussion contributions from all students are expected in each class, particularly for the cases assigned for that day. Reference readings are provided for each class, but students should also search for additional sources of material upon which to base their discussions. Each presentation will be followed by a general class discussion of issues related to the topic, and students will receive a mark based on their contribution to class discussions. Some sessions will be enriched by invited speakers. Assignments are to be completed individually and submitted during the term in Avenue.

Student groups will develop term projects on topics relevant to healthcare analytics and present them during the last week of the term. All team members must participate in presenting the project and in preparing the written version of the project. This material is NOT to be regarded by eHealth

students to be used for potential scholarly papers to meet eHealth program requirements. Term projects are to be decided after discussion and agreement with the instructor. The deadline for deciding on group term projects is week five of the term, when an abstract of the proposed project has been approved by the instructor.

The purpose of the group project is to demonstrate an ability to work as a team to read, collect, work with, clean, analyze and visualize a health data set/ or health datasets. The goal is to create an analytical data product (story, data dashboard(s)) to show the techniques and analytical skills learned during the course. Your mark will depend on 4 major topics of analytics: data management, statistical analysis, data mining and/or predictive analytics and visualization. You will be required to submit:

1.1 A prepared data set for analysis.
1.2 A syntax used for data preparation and for performing the analysis.
1.3 A codebook that describes the variables, and any new variables/transformed variables that were used to clean up the data;
2. Data product (using Tableau, Watson Analytics, or QlikSense):
2.1 Interactive data for exploratory analysis.
2.2. Modeling: at least 3 statistical tests.
2.3. Modeling: at least 1-2 data mining methods and/or predictive analytics methods should be used for analysis.

Term project story should include title page, key findings, objective of analysis, findings, references, plus appendices as appropriate. All analyses should be visualized and interpreted.
Exceptions to this list may be allowed if discussed beforehand with the instructor.
Your final grade will be calculated as follows:

Components and Weights

Individual participation in class discussions	20%
Individual assignments (2-3)	20%
Group presentation on term project	25%
Written group term project report	35%
Total	100%

Grade 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
A+	90 - 100
A	85 - 89
A-	80 - 84
B+	77 - 79
B	74 - 76
B-	70 – 73
F	00 - 69

Communication and Feedback

Students who are uncomfortable in directly approaching an instructor regarding a course concern may send a confidential and anonymous email to the respective Area Chair or Associate Dean:

http://www.degroote.mcmaster.ca/curr/emailchairs.aspx

Students who wish to correspond with instructors or TAs 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. Emails regarding course issues should NOT be sent to the Administrative Assistant.

Instructors are encouraged to 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.

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/policy/Students-AcademicStudies/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

Plagiarism detected in written material may be reported to those responsible for overseeing academic integrity. You may therefore wish to submit your written term paper to Turnitin.com or Grammarly to check for plagiarism before submitting it for marking. To see guidelines for the use of Turnitin.com or Grammarly, please go to:

http://www.mcmaster.ca/academicintegrity/turnitin/students/index.html

or (for Grammarly) to: https://library.mcmaster.ca/news/8839

Missed Mid-Term Examinations / Tests / Class Participation

Where students miss a regularly scheduled mid-term or class participation for legitimate reasons as determined by the eHealth Office or MBA Academic Services Office, the weight for that test/participation will be distributed across other evaluative components of the course at the discretion of the instructor. Documentation explaining such an absence must be provided to the eHealth Office or MBA Academic Services Office within five (5) working days upon returning to school.

To document absences for health related reasons, please provide the Petition for Relief for MBA Missed Term Work and the McMaster University Student Health Certificate which can be found on the DeGroote website at http://mbastudent.degroote.mcmaster.ca/forms-and-applications/. Please do not use the online McMaster Student Absence Form as this is for Undergraduate students only. University policy states that a student may submit a maximum of three (3) medical certificates per year after which the student must meet with the Director of the program.

To document absences for reasons other than health related, please provide a Petition to the eHealth Office or the Petition for Relief for MBA Missed Term Work and documentation supporting the reason for the absence.

Students unable to write a mid-term at the posted exam time due to the following reasons: religious; work-related (for part-time students only); representing university at an academic or varsity athletic event; conflicts between two overlapping scheduled mid-term exams; or other extenuating circumstances, have the option of applying for special exam arrangements. Such requests must be made to the MBA Academic Services Office or (for eHealth students) the eHealth Program Office at least ten (10) working days before the scheduled exam along with acceptable documentation. Instructors cannot themselves allow students to unofficially write make-up exams/tests. Adjudication of the request must be handled by the MBA Academic Services Office or eHealth Program Office.

If a mid-term exam is missed without a valid reason, students will receive a grade of zero (0) for that component.

Missed Final Examinations/Team Projects

A student who misses a final examination without good reason will receive a mark of 0 on the examination.

All applications for deferred and special examination arrangements must be made to the MBA Academic Services Office or eHealth Program Office. Failure to meet the stated deadlines may result in the denial of these arrangements. Deferred examination privileges, if granted, must be satisfied during the examination period at the end of the following term. There will be one common sitting for all deferred exams.

Failure to write an approved deferred examination at the pre-scheduled time will result in a failure for that examination, except in the case of exceptional circumstances where documentation has been provided and approved. Upon approval, no credit will be given for the course, and the notation N.C. (no credit) will be placed on the student's transcript. Students receiving no credit for a required course must repeat the course. Optional or elective courses for which no credit is given may be repeated or replaced with another course of equal credit value.

Requests for a second deferral or rescheduling of a deferred examination will not be considered.

Any student who is unable to write a final examination because of illness is required to submit the Application for Deferred Final Examination and a statement from a doctor certifying illness on the date of the examination. The Application for Deferred Final Examination and the McMaster University Student Health Certificate can be found on the DeGroote website at http://mbastudent.degroote.mcmaster.ca/forms-and-applications/ Please do not use the online McMaster Student Absence Form as this is for Undergraduate students only. Students who write examinations while ill will not be given special consideration after the fact.

In such cases, the request for a deferred examination privilege must be made in writing to the MBA Academic Services Office of eHealth Program Office within five business days of the missed examination.

Special examination arrangements may be made for students unable to write at the posted exam time due to compelling reasons (for example religious, or for part-time students only, work-related reasons):

- Students who have religious obligations which make it impossible to write examinations at the times posted should consult the relevant policy at http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-Observances.pdf
- Part-time students who have business commitments which make it impossible to write examinations at the times posted are required to produce a letter on company letterhead from the student's immediate supervisor stating that they are unable to be present owing to a specific job commitment.

In such cases, applications must be made in writing to the MBA Academic Services Office or eHealth Program Office at least ten business days before the scheduled examination date and acceptable documentation must be supplied.

If a student is representing the University at an academic or athletic event and is available at an overlapping scheduled time of the test/examination, the student may write the test/examination at an approved location with an approved invigilator, as determined by the MBA Academic Services Office or eHealth Program Office.

In such cases, the request for a deferred examination privilege must be made in writing to the MBA Academic Services Office or eHealth Program Office within ten business days of the end of the examination period.

Note: A fee of $50 will be charged for a deferred exam written on campus and a fee of $100 for deferred exams written elsewhere. In cases where the student's standing is in doubt, the Graduate Admissions and Study Committee may require that the student with one or more deferred examination privileges refrain from re-registering until the examination(s) have been cleared.

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 course work at the outset of 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 an 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 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.

RESEARCH USING HUMAN SUBJECTS

Research involving human participants is premised on a fundamental moral commitment to advancing human welfare, knowledge and understanding. As a research intensive institution, McMaster University shares this commitment in its promotion of responsible research. The fundamental imperative of research involving human participation is respect for human dignity and well-being. To this end, the University endorses the ethical principles cited in the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans:

http://www.pre.ethics.gc.ca

McMaster University has mandated its Research Ethics Boards to ensure that all research investigations involving human participants are in compliance with the Tri-Council Policy Statement. The University is committed, through its Research Ethics Boards, to assisting the research community in identifying and addressing ethical issues inherent in research, recognizing that all members of the University share a commitment to maintaining the highest possible standards in research involving humans.

If you are conducting original research, it is vital that you behave in an ethical manner. For example, everyone you speak to must be made aware of your reasons for eliciting their responses and consent to providing information. Furthermore, you must ensure everyone understands that participation is entirely voluntary. Please refer to the following website for more information about McMaster University's research ethics guidelines:

http://www.mcmaster.ca/ors/ethics

Organizations that you are working with are likely to prefer that some information be treated as confidential. Ensure that you clarify the status of all information that you receive from your client. You **MUST** respect this request and cannot present this information in class or communicate it in any form, nor can you discuss it outside your group. Furthermore, you must continue to respect this confidentiality even after the course is over.

If you plan to carry out research as part of this course that involves gathering and analyzing data from human subjects, please discuss this with your instructor well in advance of planning and implementing your study.

COURSE SCHEDULE

eHealth 746 Healthcare Analytics
Summer 2026 Course Schedule

WEEK	DATE	ASSIGNMENT	WEEK'S ACTIVITIES & READINGS**
1.	May 7	**Lecture/Presentation:** • Overview of Health Analytics • Administrative, clinical, patient-reported and external data; • Health Analytics Toolkit • Common representations of data in health classification systems (ICD-9 &10, CPT,CCI); • Case Mix Group (CMG) classification; • Personal Health Information Protection Act (PHIPA); • Course data explanation= CCHS, DAD files; • Practice 1,2 : How to find ICD10, CCI codes in DAD documentation. • SPSS introduction • **Practice 1.1-1.6** **Case 1:** Class Discussion	**Case 1 YourHealthSystem (CIHI)** http://yourhealthsystem.cihi.ca/ Group Formation (Max size 3; Mix of technical, healthcare, managerial skills as much as possible) HIMSS Analytics Survey http://webapps.qlik.com/himss/himss.html#intro Databases at http://odesi1.scholarsportal.info/webview/

2.	May 14	**Lecture/Presentation:**
		• Reading raw data (.txt, .csv, Excel,etc.)
		• Using master / standardized weights for survey data
		• Data management basic tasks part 1:
		  • Creating new variables and recording,
		  • Data documenting
		  • Subsetting variables and observations,
		  • Data documented/codebook creation
		  • **Practice 2.1-2.5**
		
		Case 2: Class Discussion
			Case 2 Lack of Healthcare IT Workers
			http://www.cio.com/article/2387609/healthcare/lack-of-healthcare-it-workers-slows-tech-progress.html
			
			Webinar: Clinical analytics in primary care
			http://www.ask.com/youtube?q=health+analytics+hsu+summit&v=uiCRc8is2A0&qsrc=472
			
			Assignment 1 (due week 3)

3.	May 21	**Lecture/Presentation:** Data management basic tasks part.2: • Sorting and splitting , • Tips for cleaning data • Missing values management • Discovering missing patterns • Missing data Imputation • **Practice 3.1-3.3** **Case 3**: Class Discussion	**Case 3 Big Data Improves Cardiology Diagnoses by 17%** http://healthitanalytics.com/news/case-study-big-data-improves-cardiology-diagnoses-by-17/
4.	May 28	**Lecture/Presentation**: Data management advanced tasks: • Collapsing data across observations 1Concatenating files (Adding cases) • Merging files • Reshaping from long format to wide format • Reshaping from wide format to long format • Practice 4.1-4.5 • Knowing your data: data audit summary Recommendations for appropriate data transformation • Cleaning techniques • Binning • Scaling and normalization methods • **Practice 4.3.1-4.3.2** Class Discussion	**Finalize decisions on group term project choices**
5.	June 4	**Lecture/Presentation** Using Simple Statistics for Data Understanding: • EDA • Frequencies, Descriptive Stat, QQ-plots • Transformations, Normalization • Association between two variables • **Practice 5.1-5.8** Class Discussion	**Assignment 2 (due week 6)**

6.	June 11	**Lecture/Presentation**
		Predictive analytics:
		• Multiple regression: simultaneous and hierarchical
		• How to interpret the regression results?
		• Automatic linear modeling
		  • Difference between standard model, boosting and bagging
		  • Interpretation and visualization of regression modeling results
		• Logistic regression
		• Confusion matrix and performance metrics: sensitivity, specificity, accuracy, etc.
		• Roc curve
		• ML Methods: NN, Random Forest, Naïve Bayes,etc
		• **Practice 6.1-6.4**
		
		Case 4: Class Discussion
			Case 4. Use Cases for Predictive Analytics
			http://healthitanalytics.com/news/four-use-cases-for-healthcare-predictive-analytics-big-data
			
			Assignment 3 (due week 8)

7.	June 18	**Lecture/Presentation** Data mining (DM) methods Part 1: • What is data mining? • Origins of DM. • Data mining versus statistical analysis • Association rules (AR) modeling • AR terminology • AR results visualization • **Practice AR modeling** **Case 5:** Class Discussion	**Case 5 Applying Data Mining to Healthcare Data Warehouse** https://static.aminer.org/pdf/PDF/000/306/788/applying_data_mining_to_software_development_projects_a_case_study.pdf
8.	June 25	**Lecture/Presentation** Data mining (DM) methods Part 2: Unsupervised learning (clustering) • What to look at when clustering • Algorithm for k-means clustering in Excel • How to determine optimal number of clusters in k-means clustering • Interpreting the clustering results Cluster evaluation • Cluster visualization • Two-step clustering • Cluster prototypes and interpretation • **Practice clustering** Class Discussion	

9.	July 2	**Lecture/Presentation** Data mining (DM) methods Part 3: Decision trees (DTs) and model scoring • Main tasks for DT predictive analytics • How to interpret the results • Misclassification costs • PMML – Predictive model markup language • Scoring/Deploying predictive models • DT scoring example • **Practice DT modeling** Class Discussion	
10.	July 9	**Lab Session** StoryTelling with Tableau Part1: • Introduction to Tableau • Connecting data • User Interface (UI) overview • Basic charts • Formatting basics • Maps intro • **Practice 10** Class Discussion	
11.	July 16	**Lab Session** Storytelling with Tableau part 2: • Creating dashboards • Telling a story • Advanced charts • Using Advanced Analytics: calculation, totals, correlation, regression, clustering • How to visualize your results from stat tests, DMs? • **Practice 11** Class Discussion	

12.	July 23	**Lab Session**
		• Developing and deploying analytical product for institutional or government agency use
		• How to develop a plan and budget for implementing a healthcare analytics undertaking:
		  • Why create an analysis plan?
		  • What does an analysis plan include?
		  • Developing a Health Analytics Roadmap
			Instructor and/or TA will be available during class hours or office hours

13.	July 30	**Group Project Presentations** Class Discussions	

****Class Schedule and Resources**

The class will be organized into teams during the second class, with a maximum of three members per team. An attempt will be made to balance expertise so that there is technical, health, and managerial/business background represented in each team. A case will be provided each week that is relevant to the topic of the week, and students are expected to come to class prepared to discuss the case.

Class members will all be expected to become familiar with the SPSS and Tableau software packages and demonstrate their expertise by applying the software to assignments where relevant. All practices, examples and visualizations are provided with real health data.

Students are expected to attend lab sessions that will mostly involve planning and developing the group projects (class sessions 9 through 12). This will give an opportunity to interact with other team or class members, or to discuss issues with the instructor or tutorial assistant, who will also be available during office hours for consultations.