eHealth 705
Statistics for eHealth
Winter 2022 Course Outline
This is an online learning course

MSc eHealth Program, McMaster University

COURSE OBJECTIVE

This course covers basic statistical concepts and techniques as they apply to the analysis and presentation of data in eHealth practice. Students will learn and apply concepts and techniques to typical problems that arise in eHealth studies and develop an awareness and understanding of published studies in eHealth-related journals.

INSTRUCTOR AND CONTACT INFORMATION

Dr. Ken Deal
Instructor
deal@mcmaster.ca

Office: Online
Office Hours: Mondays @ 11:30am
& by appointment
Tel: (905) 525-9140 x27430
Webinars: Scheduled Mondays 11:30am –1:00pm

Teaching Assistant
Dr. Ana Gabrielyan
anaitgabrielyan@gmail.com

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):	No	Final Exam:	No	Online:	Yes

COURSE DESCRIPTION

This course covers basic statistical concepts and techniques as they apply to the analysis and presentation of data in eHealth practice. Extensive use is made of the R statistical software environment, R packages and the R GUIs RStudio as well as StatKey and GPower. The course includes graphic and tabular presentation of data, elementary probability, descriptive statistics, and probability distributions. Statistical techniques include contingency tables and chi-square tests, null hypothesis statistical testing, confidence intervals, hypothesis tests (z-tests, t-tests, and non-parametric methods), ANOVA, simple and multiple regression, correlation, logistic regression, decision trees, trials characteristics and survival models. Students will analyze data gathered from public sources and previous statistical studies in eHealth and will review examples drawn from published studies relating to eHealth in journals such as the Journal of Medical Internet Research (JMIR), the Journal of the American Medical Informatics Association (JAMIA) and others.

LEARNING OUTCOMES

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

- Review and comment on proposals relating to the collection and analysis of data;
- Detail implementation plans for modeling and analyzing specific data sets;
- Decide on appropriate statistical techniques (e.g. parametric or non-parametric) for analyzing data;
- Define suitable models for data analysis (e.g. linear regression or logistic regression or decision trees);
- Review and clean data sets before analyzing the data they contain;
- Determine whether statistical estimates are significant or not;
- Write reports that provide suitable results that support decision makers in making appropriate eHealth decisions; and
- Find suitable published papers and review their findings critically and make suggestions for related studies in specific environments.

COURSE MATERIALS AND READINGS

Avenue registration for course content, readings and case materials http://avenue.mcmaster.ca
R for Health Data Science, Harrison and Pius, 2020. From McMaster bookstore and https://argoshare.is.ed.ac.uk/healthyr_book/
Fox, John (2017). ***Using the R Commander: A Point-and-Click Interface for R***. Boca Raton, Florida: CRC Press. Optional.
Rodrigues, Bruno (2019). *Modern R with the tidyverse*. You can buy this book from https://leanpub.com/modern_tidyverse , or you can read the book online for free: https://b-rodrigues.github.io/modern_R/. Optional.
R software, RStudio, R Commander, Rattle, StatKey and GPower, all open source and free.

OPTIONAL COURSE MATERIALS AND READINGS

Essex-Sorlie D. Medical Biostatistics & Epidemiology, London: Prentice-Hall International, 1995.	
Machin D, Campbell M, Walters S. Medical Statistics: A textbook for the health sciences. 4th edition. West Sussex, England: John Wiley & Sons Ltd. 2007.	
Lock x 5. Statistics: Unlocking the power of data. Hoboken NJ: John Wiley & Sons, Inc. 2013. (Highly recommended.)	
Crawley M. The R Book. West Sussex, England: John Wiley & Sons Ltd. 2008.	

EVALUATION

The main learning platform in this course will be asynchronous content videos accompanied by PowerPoint decks and R Markdown documents, 6 assignments, synchronous webinars, intra-course chats and a term project.

Webinars will review past assignments, preview future assignments, discussion topics and Q&A and will be on Mondays from 11:30am to 1:00pm, approximately (see schedule). The topic videos will introduce, discuss and provide examples of all course material and will be backed up by PowerPoint decks and/or R Markdown documents.

The balance of the learning results from lectures on statistical methodologies, relevant readings from the literature on statistical applications in eHealth and working in teams to analyze and present findings from data sets. The team term project will be comprised of analysis and write-up of the analysis of a data set. Final grades will be calculated as follows.

Components and Weights

Assignments ~6, evenly weighted		60%
Term Project (group)	Presentation	5%
Term Project (group)	Written Report	35%
Total		100%

NB: Assignments must be submitted to Avenue by the date and time stated in the syllabus. The dropbox will be closed as of the required submission time and late assignments will not be accepted.

NOTE: The use of a McMaster standard calculator is allowed during examinations in this course. See McMaster calculator policy at the following URL:

http://www.mcmaster.ca/policy/Students-AcademicStudies/examinationindex.html

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	73 - 76
B-	70 – 72
F	00 - 69

COURSE DELIVERABLES

Assignments

There will be 6 assignments during the term. These will constitute 60% of your final mark. These assignments must be done by each individual student and submitted to the Avenue Drop Box when required. The assignments will be scrutinized for cheating and appropriate steps will be taken if collaboration is discovered. Each assignment must be placed in the appropriate Avenue Drop Box by the required time and date. The Avenue dropbox will close at the prescribed time. Late assignments will receive grades of zero. This is a statistics + eHealth course, i.e., the analysis must be done correctly and to the proper extent and the results must be interpreted to support better health decisions. The lack of either of these two essential components will cause reduction in grades. Feedback will be provided through Avenue. All assignments must be written in R Markdown and both HTML and R Markdown files must be submitted unless otherwise specified by the professor.

Midterm

There will be no midterms.

Term Projects

The term projects will be focused on providing commercial grade experiences in eHealth analytics. These projects will be assigned to teams and it is expected that each team member contribute appropriately and equally to the end result. There will be a vehicle for adjusting grades if a team member were to not participate adequately. The term projects will be presented orally during the scheduled final examination period for this course. Essentially, these will be the final exams.

Final Marks in eHealth 705

A passing mark in eHealth 705 indicates that the professor attests that the student has at least an adequate proficiency in statistics for health analytics and should be able to contribute to the analytical functions of health organizations. If the professor is not able to attest to this achievement, the student will receive a grade of F.

COMMUNICATION AND FEEDBACK

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

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at:

www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations

AUTHENTICITY/PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software.

All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names 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 a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

ON-LINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

MISSED ACADEMIC WORK

Missed Examinations / Tests / Class Participation

Students can apply for relief of missed term work if they have or are going to miss an evaluated portion of their course. Please contact the Program Administrator for more information.

Students can request relief for:

- Health-related or extenuating circumstances
- Work-related commitments (for part-time students only)
- Representing the University at an academic or varsity event
- Religious obligations
- Conflicts between two (or more) overlapping scheduled mid-term exams

Requesting Relief for Missed Term Work

If a portion of your term work is missed for legitimate reasons, as determined by Program Administrator, the weight for that missed term work will be redistributed across the other assignments and exams of the course. For missed work, forms and supporting documentation must be submitted to Program Administrator within five (5) business days of missing the work or mid-term exam.

Requesting Relief for Term Work in Advance

If evaluated term work is missed, students can request for relief/special arrangement in advance. Supporting documentation must be submitted to the Program Administrator at least ten (10) working days before the mid-term exam, test, assignment, etc.

The program administrator will provide the required forms to the student. Please complete the Petition for Missed Term Work form in addition to:

- For medical reasons the McMaster University Student Health Certificate and for extenuating circumstances, appropriate documentation is required.
- Due to a business commitment (for part-time students only), have your immediate supervisor provide you with a letter on company letterhead stating that you are unable to be present due to a specific job commitment.
- For varsity reasons, have a designated University official provide a letter on university letterhead; or
- For religious reasons, have your religious leader provide a letter stating that you are unable to be present due to a religious obligation.

In all cases, the request must be handled by The Program Administrator. The appropriate distribution of re-weighting term work will be determined by the instructor. Submitting a request does not guarantee approval or special consideration.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

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

RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

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

ONLY IF APPLICABLE

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://reo.mcmaster.ca/

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.

ACKNOWLEDGEMENT OF COURSE POLICIES

Your registration and continuous participation (e.g. on A2L, in the classroom, etc.) to the various learning activities of eHealth 705 will be considered to be an implicit acknowledgement of the course policies outlined above, or of any other that may be announced during lecture and/or on A2L. **It is your responsibility to read this course outline, to familiarize yourself with the course policies and to act accordingly.**

Lack of awareness of the course policies **cannot be invoked** at any point during this course for failure to meet them. It is your responsibility to ask for clarification on any policies that you do not understand.

The tentative schedule of course topics is on the following page.

(The topics, contents and timing may be changed by the professor.)

Epoch	Topic	Content	Begin	Webinars	Assignments	Due Dates
1 Introduction	1	Brief introduction to statistics for eHealth	10-Jan-22	W1, 10jan22 @ 1130		
	2	How will this course operate?	10-Jan-22			
2 Technical preparation	3	Technical course preparation 1 -- installing R	10-Jan-22			
	4	Technical course preparation 2 -- installing R Studio	10-Jan-22			
	5	Technical course preparation 3 -- installing R packages	10-Jan-22			
	6	Technical course preparation 4 -- installing R Commander	10-Jan-22			
	7	Technical course preparation 5 -- R Markdown	10-Jan-22			
3 eHealth research	8	eHealth and eHealth research	10-Jan-22			
	9	The research process	10-Jan-22			
4 Exploratory data analysis	10	Using the basics of R	17-Jan-22			
	11	Data sources and types	17-Jan-22			
	12	Exploratory Data Analysis 1, Getting to know the data.	17-Jan-22			
	13	Exploratory Data Analysis 2, descriptive statistics	17-Jan-22			
	14	Exploratory Data Analysis 3, missing values, zeros and blanks	17-Jan-22	W2, 17jan22 @ 1130		31jan22 @ 1030
5 Statistical preparation	15	Experiments	24-Jan-22			
	16	Populations, samples and sampling	24-Jan-22			
	17	Central Limit Theorem	24-Jan-22			
	18	Bootstrapping	24-Jan-22	W3, 24jan22 @ 1130		
6 Null hypothesis significance testing	19	NHST: Null Hypothesis Significance Testing, most basic	31-Jan-22			
	20	NHST - Are the sample observations normally distributed?	31-Jan-22			
	21	NHST: Confidence Intervals	31-Jan-22			
	22	NHST: Is the mean different from that number?	31-Jan-22			
	23	NHST: Are two means different (independent samples)?	31-Jan-22	W4, 31jan22 @ 1130	Assignment 1	31jan22 @ 1030
	24	NHST: Effect size and power	07-Feb-22			
	25	NHST: Are two means different (paired samples)?	07-Feb-22			
	26	NHST: Are two proportions different?	07-Feb-22	W5, 07feb22 @ 1130		28feb22 @ 1030
	27	NHST: Mann-Whitney U test & Wilcoxon signed rank test	14-Feb-22			
	28	NHST: Are the means among several groups different (ANOVA)?	14-Feb-22			
	29	NSHT: Are the variances among several group different (ANOVA)?	14-Feb-22	W6, 14feb22 @ 1130		
	30	NHST: Are observations from several groups normally distributed?	28-Feb-22			
	31	NHST: Do observations come from different distributions (non-parametri	28-Feb-22	W7, 28feb22 @ 1130	Assignment 2	28feb22 @ 1030
	32	NHST: Are repeated measures different	07-Mar-22			
	33	NHST: Are two categorical variables related?	07-Mar-22			
	34	NHST: Correlation	07-Mar-22	W8, 07mar22 @ 1130		
7 Simple Linear Regression	35	Simple linear regression basics using StatKey	14-Mar-22			
	36	Simple linear regression basics using Rcmdr	14-Mar-22			
	37	Simple linear regression. How good is your model? Part A	14-Mar-22			
	38	Simple linear regression. How good is your model? Part B	14-Mar-22	W9, 14mar22 @ 1130	Assignment 3	14mar22, 1030
8 Multiple Linear Regression	39	Multiple linear regression basics	21-Mar-22			
	40	Multiple linear regression, reducing the model	21-Mar-22			
	41	Multiple linear regression, predicting and diagnostics	21-Mar-22			
	42	Multiple linear regression, How good is your model?	21-Mar-22			
	43	Multiple linear regression, categorical predictors	21-Mar-22			
	44	Multiple linear regression, How good is your model?	21-Mar-22	W10, 21mar22 @ 1130	Assignment 4	21mar22, 1030
9 Logistic Regression	45	Logistic regression basics	28-Mar-22			
	45a	Logistic regression on categorical predictors	28-Mar-22			
	46	Logistic regression interpretation	28-Mar-22			
	47	Logistic regression, How good is your model	28-Mar-22	W11, 28mar22 @ 1130	Assignment 5	28mar22 @ 1030
10 Other Regression Topics	48	classification & regression trees	04-Apr-22			
	49	Lift and Gain metrics	04-Apr-22			
	50	Survival analysis	04-Apr-22	W12, 04apr22 @ 1130		
			11-Apr-22	W13, 11apr22 @ 1130	Assignment 6	11apr22 @ 1030
	Oral Final Exam: Presentation of Term Projects in Zoom		Final Exam date			
	Project reports due		Final Exam date			

eHealth 705 - WINTER 2022
CASE GROUP EVALUATIONS
INSTRUCTIONS:

1. You are to assign to each person in your group an amount of money which represents each individual's contribution to the case.

2. Your total budget to distribute among the people in your group is $1,000 * (the number of people in your group).

For example, if there are 5 people in your group, then pretend that you have $1,000 * 5 = $5,000 to pay out to the group.

3. If everyone contributed equally to the case, then pay each person $1,000.

4. Adjust the fee to each person according to your honest personal assessment of the value of each person's contribution. In our example, the fee could be as low as $0 or as high as $5,000.

5. Your evaluation is to be done by you with no consultation with others in your group or from other groups.

6. In most cases, these evaluations will be valuable input to your professor in allocating marks. However, your professor might decide not to use the evaluations for some groups under unusual circumstances.

7. TREAT THIS EVALUATION SERIOUSLY. THESE ARE MANDATORY TO OBTAIN A GRADE.

8. MAKE SURE THAT THE FEES PAID ADD TO $1,000 * GROUP SIZE.

YOUR NAME: _____

GROUP NAME: _____

CASE:_____

GROUP MEMBER (alphabetical order, Last, First)	FEE
_____	$_____
_____	$_____
_____	$_____
_____	$ _____
_____	$ _____

eHealth 705: Statistics for eHealth

Case Team # ___

5 person teams

Team Members: email addresses, phone numbers
(very clearly write your email addresses)

1._____

2._____

3._____

4._____

5._____

And you are … ?

Name: _____ _____(Last)

Address: _____

City: _____

Phone: _____ email: _____

Current or most recent job: _____

_____

Next previous position: _____

_____

Undergraduate degree: _____

Undergraduate university: _____

Other graduate degree: _____

Previous statistics / analytics courses _____

_____

Which of the following courses have you taken or are you taking currently?

Took Previously	Taking Currently	
❒	❒	eHealth 724, Fundamentals of eHealth & Cdn Health Care System
❒	❒	eHealth 736, Management Issues in eHealth
❒	❒	eHealth 757, Modern Software Technology for eHealth
❒	❒	eHealth 701, Research and Evaluation Methods in eHealth
❒	❒	711, Health Economics & Evaluation
❒	❒	723, Data Mining & Business Intelligence
❒	❒	6DB3, Databases
❒	❒	730, machine Learning & Data Mining
❒	❒	746, Health Analytics
❒	❒	750, Model-based Image Reconstruction