

**Epidemiology 823: Advanced Methods in Applied Biostatistics – Winter 2020**  
**Course Syllabus**

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**Class time and location:** 1:30pm - 3:00pm on Tuesday and Thursday, Jeffrey Hall 101

**Instructors and Offices:**

Name	Office	Phone	Email
Dongsheng Tu	Canadian Cancer Trials Group	77830	dtu@ctg.queensu.ca
Keyue Ding	Canadian Cancer Trials Group	77705	kding@ctg.queensu.ca
Will Pickett	201 Carruthers Hall	79551	pickettw@queensu.ca

**Office hours:** Please email respective instructor for a meeting time

**Course Description**

This course introduces some advanced methods in applied biostatistics, which include analysis of longitudinal and survival data using various regression models; Techniques and strategies for regression modeling; Multivariate analysis methods including discriminant analysis, principal components and factor analysis; Propensity score analysis.

**Course Learning Outcomes:**

After taking this course, the students should be able to

1. Understand the concepts, assumptions, theory and logic involved in some complex statistical methods used in epidemiological and clinical studies
2. Perform multivariable and multivariate analyses and develop appropriate statistical models for different types of data under different study designs
3. Use the developed models to interpret the results and draw conclusions

**Course Pre-requisites**

This course is a required course for MSc (Biostatistics) and Ph. D. (Epidemiology) students and an elective course for MSc (Epidemiology) students. Other students will be admitted only with permission of the course instructor. EPID 821 or an equivalent course plus knowledge on some basic statistical modeling techniques are the minimum requirements.

**Course Resources & Readings:**

There is no required textbook for this course. The following books can be served as references:

Johnson RA and Wichern DW (2007) Applied Multivariate Statistical Analysis (6th Edition). Prentice Hall.  
Fitzmaurice G, Laird N and Ware J (2011) Applied Longitudinal Analysis (2nd Edition). John Wiley & Sons.  
Hosmer DW, Lemeshow S, May S (2011) Applied Survival Analysis. John Wiley & Sons.  
Guo S and Fraser MW (2015) Propensity Score Analysis. SAGE.  
Rothman KJ, Greenland S, Lash TL (2008) Modern Epidemiology (3rd Edition). Wolters Kluwer.  
Katz MH (2011) Multivariable analysis: a practical guide for clinicians and public health researchers. Cambridge University Press.

## Course Schedule

Class	Date	Class Topics	Instructor
<b>Week 1</b>	January 7 and 9	Multivariate Analysis (1): Descriptive Analyses of Multivariate Data; Multivariate Normal Distribution and Its Inferences	Dongsheng Tu
<b>Week 2</b>	January 14 and 16	Multivariate Analysis (2): Analysis of Longitudinal Continuous Data	Dongsheng Tu
<b>Week 3</b>	January 21 and 23	Multivariate Analysis (3): Analysis of Longitudinal Categorical Data	Dongsheng Tu
<b>Week 4</b>	January 28 and 30	Multivariate Analysis (4): Discriminant analysis	Dongsheng Tu
<b>Week 5</b>	February 4 and 6	Multivariate Analysis (5): Principal components analysis and factor analysis	Dongsheng Tu
<b>Week 6</b>	February 11 and 13	Survival analysis (1): Survival function (curve) and hazard function; Estimation and comparison of survival functions	Keyue Ding
<b>Week 7</b>	February 25 and 27	Survival analysis (2): Multiple Survival Regression Model; Cox Proportional Hazards (Regression) Models; Competing risks	Keyue Ding
<b>Week 8</b>	March 3 and 5	Propensity Score Methods for Causal Inference (I): Causal Inference Model-Framework for causal effects, design of studies to estimate causal effects, and analysing data to estimate causal effects; Randomized Experiments	Keyue Ding
<b>Week 9</b>	March 10 and 12	Propensity Score Methods for Causal Inference (II): Covariate Balance: Design and analysis; Observational studies-Covariate Balance using propensity score, stratification, matching and weighting; examples	Keyue Ding
<b>Week 10</b>	March 17 and 19	Applied Multivariable Models (I): Objectives of regression models; Mediators (intermediate variable, causal pathway) vs confounding; Application and interpretation of coefficients; Exposure representation in regression analysis; Accounting for sampling methods	Will Pickett
<b>Week 11</b>	March 24 and 26	Applied Multivariable Models (II): Model assumptions (logistic regression) – multiplicative scale; Interaction; Confounding; Design effects; Transformation and interpretation of transformed exposures	Will Pickett
<b>Week 12</b>	March 31 and April 2	In-class presentations	Students

## Assessment

5 assignments from Dr. Dongsheng Tu	35%
2 assignments from Dr. Keyue Ding	30%
1 assignment from Dr. Will King	15%
In-class presentation	20%

## Notes

1. The minimum passing grade in Graduate School is 70% for this course.
2. Assignments are expected to be completed independently.
3. The in-class presentation can be 10 to 15 minutes with 1 or 2 minutes for questions, depending on the number of students in the class. Students can present any topic in biostatistics which is not covered by the course instructors. The following are the criteria which will be used for the evaluation of presentations by both students and instructors:
  - (1) Organization:
    - (i) A clear outline presented at the beginning and referenced throughout?
    - (ii) The presentation progressed logically with summary at the end?
  - (2) Delivery:
    - (i) Clarity of voice, pace, and appropriate use of slide display?
    - (ii) Engagement of attention and interest of audience?
  - (3) Content:
    - (i) Knowledge of subject and biostatistics content?
    - (ii) Appropriate of specific examples?
  - (4) Time Management:
    - (i) Effective use of allotted time?
    - (ii) Wrap up smoothly without rushing at the end?

## University & Course Policies

### **Participation policy**

Students are expected to demonstrate professionalism by being present and punctual, and by participating actively in all sessions.

Students must inform the Instructor in advance if they will be absent from a session because of illness or other compassionate grounds. If a session is missed, it is up to the student to gather missed information from other students who were present in order to fulfill their assessment requirements.

### ***Academic Integrity***

Academic integrity is constituted by five core fundamental values: honesty, trust, fairness, respect and responsibility. Queen's students, faculty, administrators and staff all have responsibilities to support and uphold the fundamental values of academic integrity.

[http://www.queensu.ca/calendars/sgsr/Academic\\_Integrity\\_Policy.html](http://www.queensu.ca/calendars/sgsr/Academic_Integrity_Policy.html)

### ***Accommodation of Graduate Students with Disabilities***

Queen's University is committed to achieving full accessibility for persons with disabilities. Part of this

commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact the Student Wellness, Accessibility Services Office and register as early as possible. For more information, including important deadlines, please visit the Accessibility Services website at: <http://www.queensu.ca/studentwellness/accessibility-services>

## **Helpful Resources Available to You**

### ***School of Graduate Studies Habitat***

This brings together resources for living well and staying well in grad school. There is information on: taking care of yourself and managing stress, finding friends and fun, living in Kingston, managing finances, accessibility, building a career and more. <http://www.queensu.ca/sgs/current-students/sgs-habitat>

### ***Student Wellness Services***

Student Wellness Services supports the personal, academic, and social development of students at Queen's by providing a range of programs and services including accessibility services, counselling services, and health services. Their mission is to provide a welcoming, confidential, and integrated service that is responsive to the needs of students. A full listing of services including how to make an appointment is here: <http://www.queensu.ca/studentwellness/>

### ***Student Academic Success Services***

Student Academic Success Services (SASS) comprises Learning Strategies and the Writing Centre. They offer academic support to students who wish to develop their skills in critical thinking, reading, learning, studying, writing, and self-management. <http://sass.queensu.ca/>

### ***Queen's Libraries***

You can access library materials on-site or via the internet with a Queen's net ID. In addition, you can book study space, borrow materials from other libraries, seek advice on searching for the information you need, and access information about copyright, open access and scholarly communications. For service descriptions visit: <http://library.queensu.ca/>

### ***Career Services***

Career Services provides career education and employment support services at Queen's for students in all disciplines. A comprehensive range of services are offered including drop-in career advising, supporting graduate students in making informed decisions about career options, job search strategies, and CVs/resumes. For a full description of services see: <http://careers.queensu.ca/>