STAT7127

Survival Analysis

Session 1, Fully online/virtual 2021

Archive (Pre-2022) - Department of Mathematics and Statistics

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Notice

As part of Phase 3 of our return to campus plan, most units will now run tutorials, seminars and other small group activities on campus, and most will keep an online version available to those students unable to return or those who choose to continue their studies online.

To check the availability of face-to-face activities for your unit, please go to timetable viewer. To check detailed information on unit assessments visit your unit's iLearn space or consult your unit convenor.

General Information

Unit convenor and teaching staff
Unit Convenor/Lecturer
Jun Ma
jun.ma@mq.edu.au
Contact via Email or 9850 8548
Room 526, 12WW
please refer to iLearn

Credit points
10

Prerequisites
Admission to MRes

Corequisites
STAT7310 or STAT710

Co-badged status
STAT8127

Unit description
This unit explores biostatistical applications of survival analysis. These begin with the Kaplan-Meier curve definition and its extension to the comparison of survival of several groups of subjects. The Cox proportional hazards model is introduced as a method for handling continuous covariates and parametric accelerated failure-time models are also covered. Time-dependent covariates and multiple outcomes are also considered.

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

ULO1: Demonstrate understanding of survival data by identification and application of correct models.

ULO2: Summarise and display survival data using nonparametric methods.

ULO3: Analyse survival data using the Cox proportional hazards model, including time-dependent covariates and multi-event models.

ULO4: Analyse survival data using parametric models.

ULO5: Produce appropriate displays for publication.

ULO6: Determine sample size for simple survival analysis.

General Assessment Information

ASSIGNMENT SUBMISSION: Assignment submission will be online through the iLearn page.

Submit assignments online via the appropriate assignment link on the iLearn page. A personalised cover sheet is not required with online submissions. Read the submission statement carefully before accepting it as there are substantial penalties for making a false declaration.

- Assignment submission is via iLearn. You should upload this as a single scanned PDF file.
- Please note the quick guide on how to upload your assignments provided on the iLearn page.
- Please make sure that each page in your uploaded assignment corresponds to only one A4 page (do not upload an A3 page worth of content as an A4 page in landscape). If you are using an app like Clear Scanner, please make sure that the photos you are using are clear and shadow-free.
- It is your responsibility to make sure your assignment submission is legible.
- If there are technical obstructions to your submitting online, please email us to let us know.

You may submit as often as required prior to the due date/time. Please note that each submission will completely replace any previous submissions. It is in your interests to make frequent submissions of your partially completed work as insurance against technical or other problems near the submission deadline.

LATE SUBMISSION OF WORK: All assessment tasks must be submitted by the official due date and time. In the case of a late submission for a non-timed assessment (e.g. an assignment), if special consideration has NOT been granted, 20% of the earned mark will be deducted for each 24-hour period (or part thereof) that the submission is late for the first 2 days (including weekends and/or public holidays). For example, if an assignment is submitted 25 hours late, its mark will attract a penalty equal to 40% of the earned mark. After 2 days (including weekends and public holidays) a mark of 0% will be awarded. Timed assessment tasks (e.g. tests, examinations) do not fall under these rules.

Assessment Tasks

Name	Weighting	Hurdle	Due
Assignment 1	30%	No	Week 4

Name	Weighting	Hurdle	Due
Assignment 2	40%	No	Week 8
Assignment 3	30%	No	Week 12

Assignment 1

Assessment Type [1]: Quantitative analysis task
Indicative Time on Task [2]: 10 hours
Due: **Week 4**
Weighting: **30%**

Simple analyses performed by hand to demonstrate understanding of the basic principles of survival analysis and analysis using statistical software of univariate and simple Cox models.

On successful completion you will be able to:

- Demonstrate understanding of survival data by identification and application of correct models.
- Summarise and display survival data using nonparametric methods.
- Analyse survival data using the Cox proportional hazards model, including time-dependent covariates and multi-event models.

Assignment 2

Assessment Type [1]: Quantitative analysis task
Indicative Time on Task [2]: 14 hours
Due: **Week 8**
Weighting: **40%**

Full statistical analysis of a survival data set. This requires choosing an appropriate survival model, performing diagnostic tests and modifying the model to correctly satisfy the assumptions of the Cox model and presenting the results for presentation to a general audience.

On successful completion you will be able to:

- Demonstrate understanding of survival data by identification and application of correct models.
- Summarise and display survival data using nonparametric methods.
- Analyse survival data using the Cox proportional hazards model, including time-dependent covariates and multi-event models.

Assignment 3

Assessment Type [1]: Quantitative analysis task

Indicative Time on Task [2]: 10 hours
Due: **Week 12**
Weighting: **30%**

Statistical analyses covering advance material including multiple events, time-dependent covariates, parametric models, presentation of results and sample size calculations.

On successful completion you will be able to:

- Analyse survival data using parametric models.
- Produce appropriate displays for publication.
- Determine sample size for simple survival analysis.

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[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the Writing Centre for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

Delivery and Resources

Delivery and Resources

The unit is offered only in distance mode. Our means of communication will be via notes which can be obtained from ilearn, e-mail, and forums on ilearn. Our primary communication method is via ilearn and we expect you to log in at least weekly to check for announcements and release of assignments and so on.

The unit relies heavily on the prescribed text Hosmer, Lemeshow and May (see below). The study notes provide a guide to readings in this text, as well as sometimes to other readings, which will be provided. They also provide additional explanation where this is needed. In the study notes for each module, tutorial exercises are given, mostly referring to exercises in Hosmer, Lemeshow and May.

We will be using ilearn for online discussions, posting of course notes, assignments, solutions and data sets, and submission of exercises, and assignments.

Textbooks

The prescribed text is Hosmer DW, Lemeshow S and May S (2008). Applied Survival Analysis, John Wiley and Sons, Second Edition. This is essential as it has readings which are required. Online copies are available from the library. There are numerous texts on survival analysis which you may wish to consult, but the following may be particularly helpful because of its use of Stata:

Cleves MA, Gould WW, Gutierrez RG and Marchenko Y (2010). An Introduction to Survival Analysis using Stata, Third Edition, Stata Press.

Other useful texts are:

Klein JP and Moeschberger ML (2003). Survival analysis : techniques for censored and truncated data, Springer.

Kleinbaum DG (2012). Survival analysis : a self-learning text, Springer-Verlag.

Moore, DF (2010). Applied Survival Analysis using R, Springer. (for those using R)

Therneau, TM and Grambsch, PM (2001). Modeling Survival Data: Extending the Cox Model, Springer. (more advanced treatment with code for SAS and R)

Software

We will be using Stata (version 13 or later). While Stata has a GUI we will be using the command language. It is still useful to experiment with the GUI, as the corresponding commands are available in the Review pane. Stata is available through Appstream https://mq.okta.com/ and select Appstream - Student Applications. Alternatively you can obtain your own copy of Stata, and will need to purchase it directly from the suppliers. You can place your order via the Survey Design website at https://www.surveydesign.com.au/buystudent.html . The following options are recommended:

GradPlan Stata IC 16 with perpetual licence (download for Windows, Mac or Linux, including PDF of manuals) = $AUD376

GradPlan Stata IC 16 - as above but with a one-year licence = $AUD157

GradPlan Stata IC 16 - as above but with a six month licence = $AUD81 (this will be sufficient time to complete the course)

These prices are for the downloadable version. A DVD can be sent for an additional cost but isn't justified. A valid Australian or NZ university e-mail address is required.

There is also a Small Stata option; however, this is limited to around 1,000 observations which will not be sufficient. Any of the other options have capabilities beyond what is needed for the course.

For those that haven't used Stata previously there is much introductory material on the web. A useful starting point is http://www.stata.com/links/resources-for-learning-stata/, and particularly good is https://stats.idre.ucla.edu/stata/ You should especially learn the use of do files, as these allow for storing a series of commands. If you do wish to buy an introductory text on Stata then "An Introduction to Stata for Health Researchers" by S. Juul and M. Frydenberg, Stata Press. 4th ed, 2014 is good. There are other texts available in the library.

Unit Schedule

The unit timetable is based on the BCA timetable, which this year starts a week later and only has only a one week mid-semester break (week beginning 13 April).

Module	Weeks	Content	Task Due
1	1,2 (2 March)	The nature of survival data, including censoring; the survival (or survivorship) function: definition and estimation via the Kaplan-Meier curve; the stset command in Stata;Kaplan-Meier estimate of the survival (or survivorship) function: confidence intervals and hypothesis testing.	
2	3,4 (16 March)	The density, survival, hazard and cumulative hazard functions; the Nelson-Aalen estimate of the cumulative hazard function; Definition of the proportional hazards model; construction of the partial likelihood for the Cox model; the treatment of tied failure times; hypothesis testing on the coefficients, using Wald and partial likelihood ratio tests.	
3	5,6 30 March)	For the Cox PH model: hypothesis testing on the coefficients, contd; estimation of the baseline functions $S_0(t)$ and $H_0(t)$, and their adjustment for covariate values; the effect of a change in scale and origin of units of measurement of covariates.	Assignment 1
	(13 April)	Mid Semester Break	
4	7,8 (20 April)	Model diagnostics for the Cox PH model; the stratified Cox model (Assignment 1 due)	
5	9,10 (4 May)	Time-dependent covariates in the Cox model; parametric survival time models, in particular the accelerated failure time model, with an exponential and Weibull distrubution; discrete-time logistic model (Assignment 2 due)	Assignment 2
6	11,12 (18 May)	Correlated survival data; clustered survival data; recurrent events models	
7	13 (1 June)	Sample size determination for comparing two response rates and two survival distributions; good practice for the display of survival analysis results in scientific publications. (Only 1 week) (Assignment 3 due)	Assignment 3

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about

throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to help you improve your marks and take control of your study.

- Getting help with your assignment
- Workshops
- StudyWise
- Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

If you are a Global MBA student contact globalmba.support@mq.edu.au

IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.