

## Department of Epidemiology and Biostatistics

### Epidemiology 4615B/9530B Health Economic Evaluation Winter 2021

**Time:**

Monday: 1:30 p.m. – 3:30 p.m.

Thursday: 3:30 p.m. – 4:30 p.m.

**Instructor:** Sisira Sarma**Office Hours:** Monday 3:30 p.m.– 5:00 p.m.  
or by appointment (Zoom)**E-mail:** [ssarma2@uwo.ca](mailto:ssarma2@uwo.ca)**Location:** Online Synchronous (Zoom)**Teaching Assistant:** Michael Hong**E-mail:** [mhong26@uwo.ca](mailto:mhong26@uwo.ca)**Office Hours:** TBA

### Course Information

**Prerequisite:** EPI 4600A / Econ 2261A/B / EPI 9572Q or equivalent

Unless you have either the requisites for this course or written special permission from the Undergraduate/graduate Chair to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

### Course Syllabus

This course is designed to provide students with theoretical foundations and empirical methods to evaluate health interventions from an economics perspective. More emphasis will be placed on the methods to evaluate health programs, policies and interventions arising in the field of modern health economics. The topics to be covered are: cost-effectiveness analysis, cost-benefit analysis, decision-analytic models, Markov models, sensitivity analysis, Monte Carlo simulation and analysis of health care costs. This course will also provide students with a hands-on experience in conducting empirical cost-effectiveness analysis using TreeAge Pro and STATA software packages.

### Learning Outcomes:

By the end of this term, students should be able to:

- critically appraise published literature on health economic evaluations;
- identify the differences among cost-minimization, cost-effectiveness, cost-benefit, and cost-utility analyses and know the strengths and weaknesses of each technique;
- understand the importance of perspective, time horizon and discounting in economic evaluation;
- build decision-analytic models to conduct cost-effectiveness analysis using TreeAge software;
- extract effectiveness data from the clinical/epidemiological literature to populate decision-analytic models;
- conduct applied health economics analysis using TreeAge and STATA software packages, including Monte Carlo simulations;
- conduct health care cost analyses using appropriate regression models (if time permits); and
- conduct economic evaluation using patient-level data (if time permits).

### **Software:**

We will be using TreeAge Pro and STATA software packages. Students in the Department of Epidemiology and Biostatistics may be eligible to claim reimbursement of the cost of the TreeAge Pro Student Version (@ US\$55) subject to availability of Department funds. Shall be announced in the class if reimbursable and the submission process.

**Please Note:** TreeAge Pro 2009 and STATA available on Epidemiology & Biostatistics Computer Lab are for teaching purposes only and the licenses do not permit for research. This means you are required to purchase student versions of software packages for your thesis research.

## **Course Materials**

### **Textbook:**

There is no assigned textbook for this course. We will instead focus on selected materials from several books, selected journal articles and handouts. This course will cover core health economics evaluation topics.

### **Useful Reference Texts:**

#### **Health Economic Evaluation:**

Neumann PJ, Sanders GD, Russell LB, Siegel JE, Ganiats TG, eds. Cost-Effectiveness in Health and Medicine. 2<sup>nd</sup> edition, New York, NY: Oxford University Press, 2016 (available online through Western Library).

Edlin R, McCabe C, Hulme C, Hall P and Wright J. Cost Effectiveness Modelling for Health Technology Assessment: A Practical Course. Springer 2015 (available online through Western Library).

- Drummond MF, Sculpher MJ, Torrance GW, O'Brien, BJ, Stoddart GL. *Methods for the Evaluation of Health Care Programmes*, 4<sup>th</sup> edition. Oxford University Press: New York, 2015.
- Gray AM, Clarke PM, Wolstenholme J, Wordsworth S. *Applied Methods of Cost-effectiveness Analysis in Health Care*. Oxford University Press, 2010.
- Briggs A, Sculpher M, Claxton K. *Decision Modelling for Health Economic Evaluation*. Oxford University Press, 2007.
- Myriam Hunink MG, Weinstein MC, Wittenberg E, Drummond MF, Pliskin JS, Wong JB et al. *Decision Making in Health and Medicine: integrating evidence and values*. 2<sup>nd</sup> edition. Cambridge: Cambridge University Press, 2014.
- Muennig P, Bounthavong M. *Cost-Effectiveness Analysis in Health: A Practical Approach*, 3<sup>rd</sup> edition. John Wiley & Sons: San Francisco, 2016.
- McIntosh E, Clarke P, Frew E, Louviere J. *Applied Methods of Cost-benefit Analysis in Healthcare*. Oxford University Press, 2010.

### **Analysis of costs and Healthcare Resource Utilization:**

- Deb, P Norton EC and Manning WG. *Health Econometrics Using Stata*, 1<sup>st</sup> edition, Stata Press, 2017.
- Glick HA, Doshi JA, Sonnad SS, Polsky D. *Economic Evaluation in Clinical Trials*, 2<sup>nd</sup> edition. Oxford University Press, 2014.
- Jones A, Rice N, Bago dUva T, Bali S. *Applied Health Economics*, 2<sup>nd</sup> edition. Routledge, 2012 (Chapters 3 and 12).

## **I. Health Economic Evaluation**

### **Cost-effectiveness, Cost-utility and Cost-benefit Analyses**

**Readings:** Neumann et al., Chapter 2; Edlin et al., Chapters 1-2; Drummond *et al.*, Chapters 5-7; Gray et al., Chapters 2,5.

**Optional Text:** Brazier J, Ratcliffe J, Salomon JA, Tsuchiya A. *Measuring and Valuing Health Benefits for Economic Evaluation*. Oxford University Press: New York, 2007.

### **Recommended Articles**

- Guidelines for the economic evaluation of health technologies: Canada. 4<sup>th</sup> edition. Ottawa: CADTH; 2017.  
[https://cadth.ca/sites/default/files/pdf/guidelines\\_for\\_the\\_economic\\_evaluation\\_of\\_health\\_technologies\\_canada\\_4th\\_ed.pdf](https://cadth.ca/sites/default/files/pdf/guidelines_for_the_economic_evaluation_of_health_technologies_canada_4th_ed.pdf)
- Husereau et al. 2013. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement. Available at: <http://www.biomedcentral.com/1741-7015/11/80>
- Provenzale D. An overview of economic analysis for the practising gastroenterologist and hepatologist. *European Journal of Gastroenterology and Hepatology* 2004, 16(6): 513-517.

- Severens JL, Milne RJ. Discounting health outcomes in economic evaluation: the ongoing debate. *Value in Health* 2004, 7(4): 397-401.
- Claxton K, Paulden M, Gravelle H, Brouwer W, Culyer AJ Discounting and decision making in the economic evaluation of health-care technologies. *Health Economics*, 2011, 20(1), 2-15.
- Donaldson C, Birch S and Gafni A. The distribution problem in economic evaluation: income and the valuation of costs and consequences of health care programmes. *Health Economics* 2002, 11(1): 55-70.

Additional journal articles may be assigned.

## **II. Modelling in Health Economic Evaluation**

Gray et al., Chapters 8-11

Briggs et al., Chapters 2-4

Edlin et al., Chapters 3-10

TreeAge Pro Suite 2020 User's Manual, Chapters 33-37 (required), 41-44 (if time permits).

Williamstown (MA): TreeAge Software Inc.

### **a. Decision-analytic Models**

#### **Recommended Articles**

- Inadomi JM. Decision analysis and economic modelling: a primer. *European Journal of Gastroenterology and Hepatology* 2004, 16(6): 535-542.
- Soto J. 2002. Health economic evaluations using decision analytic modeling. Principles and practices – utilization of a checklist to their development and appraisal. *International Journal of Technology Assessment in Health Care*. 2002. 18(1): 94-111.
- Siebert U. When should decision-analytic modeling be used in the economic evaluation of health care? *European Journal of Health Economics* 2002, 4(3): 143-150.
- Weinstein MC, O'Brien B, Hornberger J, Jackson J, Johannesson M, McCabe C, and Luce BR; ISPOR Task Force on Good Research Practices--Modeling Studies. Principles of good practice for decision analytic modeling in health-care evaluation: report of the ISPOR Task Force on Good Research Practices--Modeling Studies. *Value in Health* 2003, 6(1): 9-17.
- Chiba N, Gralnek IM, Moayyedi P, Provenzale D, Inadomi JM, Willan AR, Briggs AH, Kim WR. A glossary of economic terms. *European Journal of Gastroenterology and Hepatology* 2004, 16(6): 563-565.

Additional journal articles may be assigned.

### **b. Markov Models and Microsimulation Models**

#### **Recommended Articles**

- Briggs A, Shulpher M. An introduction to Markov modeling for economic evaluation. *Pharmacoeconomics* 1998, 13(4): 397-409.
- Sonnenberg FA, Beck JR. Markov models in medical decision making: a practical guide. *Medical Decision Making* 1993, 13(4): 322-338.

Bala MV, Mauskopf JA. Optimal assignment of treatments to health states using a Markov decision model: an introduction to basic concepts. *Pharmacoeconomics*, 24(4): 345-354.

Additional journal articles may be assigned.

### c. **Obtaining Probabilities from Clinical/Epidemiological Studies**

#### **Recommended Articles**

Fleurence RL, Hollenbeak CS. Rates and probabilities in economic modelling: transformation, translation and appropriate application. *Pharmacoeconomics* 2007;25(1):3-6.

Ishak KJ, Kreif N, Benedict A, Muszbek N. Overview of parametric survival analysis for health-economic applications. *Pharmacoeconomics*. 2013 Aug; 31(8):663-75.

Guyot P, Ades AE, Ouwens MJ, Welton NJ. Enhanced secondary analysis of survival data: reconstructing the data from published Kaplan-Meier survival curves. *BMC Medical Research Methodology* 2012 Feb 1;12:9. **(Note:** the authors provide their R codes)

Diaby V, Adunlin G, Montero AJ. Survival modeling for the estimation of transition probabilities in model-based economic evaluations in the absence of individual patient data: a tutorial. *Pharmacoeconomics* 2014 Feb;32(2):101-108. **(Note:** authors supplied their digitized data and approximate survival data based on the algorithm of Guyot *et al.*, 2014)

Wei Y, Royston P. 2017. Reconstructing time-to-event data from published Kaplan–Meier curves. *Stata Journal* 2017, 17(4), 786-802.

### III. **Analysis of Costs and Healthcare Resource Utilization:**

Deb et al.

Glick et al., Chapters 5-6

Jones et al., Chapters 3, 12

#### **Recommended Articles**

Basu A, Manning WG. Issues for the next generation of health care cost analyses. *Medical Care*, 2009, 47(7 Suppl 1):S109-14.

Mullahy, J. Econometric modeling of health care costs and expenditures: a survey of analytical issues and related policy considerations. *Medical Care*, 2009 Jul; 47(7 Suppl 1):S104-8.

Basu A, Rathouz P. Estimating marginal and incremental effects on health outcomes using flexible link and variance function models. *Biostatistics* 2005; 6(1): 93-109.

Basu A Extended generalized linear models: Simultaneous estimation of link and variance functions. *The Stata Journal* 2005; 5(4): 501-516.

Additional journal articles may be assigned.

#### **IV. Economic Evaluation Using Patient-level data and Uncertainty**

Glick et al., Chapters 7-9

Drummond *et al.* Chapter 8

Gray et al., Chapter 4

#### **Recommended Articles**

Glick, HA. Sample size and power for cost-effectiveness analysis. *Pharmacoeconomics* 2011; 29 (3): 189-198.

Hoch JS, Briggs AH, Willan AR. Something old, something new, something borrowed, something blue: a framework for the marriage of health econometrics and cost-effectiveness analysis. *Health Economics* 2002, 11(5): 415-430.

Hoch, JS, Antoinette, Rock MA, and Krahn AD. Using the net benefit regression framework to construct cost-effectiveness acceptability curves: an example using data from a trial of external loop recorders versus Holter monitoring for ambulatory monitoring of "community acquired" syncope. *BMC Health Services Research* 2006, 6:68 doi:10.1186/1472-6963-6-68.

Polsky D, Glick HA, Willke R, Schulman K. Confidence intervals for cost-effectiveness ratios: a comparison of four methods. *Health Economics* 1997, 6(3): 243-252.

Additional journal articles may be assigned.

#### **Methods of Evaluation**

In order to really understand applied health economics analysis, you need to have the experience of doing it by yourself. Assignments during the term will include problem solving exercises. Some problems will involve use of TreeAge Pro and STATA software packages to find solutions. You will be practicing the necessary steps to learn how to ask your software package for what you want and then how to interpret and explain the results.

The assignments will be based on lecture material, assigned readings from the textbooks, journal articles and all other assigned course materials. You can work together with your fellow classmates on the assignments, but the answers and interpretation of the results and analysis should be your own. The course assessment will be based on class participation and presentation, four assignments, and a final project.

The course requirements and their weights in the final grade are as follows:

- 15% - Regular class attendance, in-class quizzes, class participation and presentation
- 30% - Three Assignments: February 08, March 08, April 02 (dates are subject to change)
- 20% - Mid-term Exam: March 15, 2020 (class time)
- 35% - Take Home Final Exam in April 2020 (Date: TBD)

## Technology Requirements

You are responsible for all required course materials and announcements posted to the course's OWL website. Please ensure after the first class that when you log in you are able to access the course site. A copy of the course outline will be available on both OWL and the departmental website. This year, additional technical requirements are:



Stable internet connection  
(required)



Laptop or computer (required)



Working microphone (required)



Working webcam (optional)

## Statement on Copyright and Audio/Video Recording

All of the remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals participating in the course for their private or group study purposes. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

You must always ask permission to record another individual and you should never share or distribute recordings.

Course material produced by faculty is copyrighted and to reproduce this material for any purposes other than your own educational use contravenes Canadian Copyright Laws.

## Absence from Course Commitments

### Undergraduate Students:

#### [Policy on Academic Consideration for Student Absences](#)

If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. Approval can be granted either through a **self-reported absence** or via the **Academic Counselling** unit. Students have two self-reports to use throughout the academic year; absence from course commitments including tests, quizzes, presentations, labs, and assignments that are worth 30% or less can be self-reported. Self-reported absences cover a student for 48 hours (yesterday + today or today + tomorrow). Your instructor will receive notification of your consideration; however, you should contact your instructor immediately regarding

your absence. Students are expected to submit missed work within 24 hours of the end of the 48-hour period. Please review details of the university's policy on academic consideration for student absences at the above link.

If you have used both their self-reported absences or will miss more than 48 hours of course requirements, a Student Medical Certificate (SMC) should be signed by a licensed medical or mental health practitioner and you should contact academic counselling. Academic Counselling will be operating virtually this year and can be contacted at [scibmsac@uwo.ca](mailto:scibmsac@uwo.ca).

### **Graduate Students:**

All accommodations are to be discussed and arranged with the course instructor.

### **Accommodation for Religious Holidays**

The policy on Accommodation for Religious Holidays can be viewed [here](#).

### **Statement on Academic Offences**

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence:

- Undergraduate students:  
[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).
- Graduate students:  
[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_grad.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf)

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

### **Support Services**

As part of a successful student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing

your degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre. Numerous cultural events are offered throughout the year. Please check out the Faculty of Music web page <http://www.music.uwo.ca/>, and our own McIntosh Gallery <http://www.mcintoshgallery.ca/>. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>

Registrarial Services: <http://www.registrar.uwo.ca>  
USC Student Support Services: <http://westernusc.ca/services/>  
Student Development Centre: <http://www.sdc.uwo.ca/>  
SGPS Life & Community web page: [https://grad.uwo.ca/life\\_community/self/index.html](https://grad.uwo.ca/life_community/self/index.html)

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate or undergraduate chair), or other relevant administrators in their unit.

Students who are in emotional/mental distress should refer to Mental Health@Western <http://www.uwo.ca/uwocom/mentalhealth/> for a complete list of options about how to obtain help.

## **Student Accessibility Services**

Western is committed to achieving barrier-free accessibility for all its members, including graduate students. As part of this commitment, Western provides a variety of services devoted to promoting, advocating, and accommodating persons with disabilities in their respective graduate program.

Graduate students with disabilities (for example, chronic illnesses, mental health conditions, mobility impairments) are encouraged to register with Student Accessibility Services, a confidential service designed to support graduate and undergraduate students through their academic program. With the appropriate documentation, the student will work with both SAS and their graduate programs (normally their Graduate Chair and/or Course instructor) to ensure that appropriate academic accommodations to program requirements are arranged. These accommodations include individual counselling, alternative formatted literature, accessible campus transportation, learning strategy instruction, writing exams and assistive technology instruction.

## **Department & Faculty Offices**

The Epidemiology and Biostatistics main office is located in K201 in the Kresge Building on Main campus.

For undergraduate academic counselling assistance, students will need to speak with the Science & Basic Medical Sciences Academic Counselling Office: <https://www.uwo.ca/sci/counselling/>.