

Department of Epidemiology and Biostatistics

Epidemiology 4615B/9530B Health Economic Evaluation Winter 2020

Time:

Monday: 1:30 p.m. – 3:30 p.m.

Thursday: 3:30 p.m. – 4:30 p.m.

Location: Room LWH 2205

Instructor: Sisira Sarma

Office Hours: Monday 3:30 p.m.– 5:00 p.m.

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Phone Extension: 87583

Teaching Assistant: TBA

E-mail: TBA

Office Hours: TBA

Course Information

Prerequisite: 4600A/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. If time permits, selected special topics on treatment effects using observational data will be considered. 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);
- conduct economic evaluation using patient-level data (if time permits); and
- undertake treatment effects analysis using observational data (if time permits).

Software:

We will be using TreeAge Pro and STATA software packages. STATA is available on Epidemiology & Biostatistics Computer Lab (Room # K7). 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 and selected advanced topics depending in part on the interests of students and availability of time.

Useful Reference Texts:

Health Economic Evaluation:

- Neumann PJ, Sanders GD, Russell LB, Siegel JE, Ganiats TG, eds. Cost-Effectiveness in Health and Medicine. 2nd edition, New York, NY: Oxford University Press, 2016 (available online through Western Library).
- Drummond MF, Sculpher MJ, Torrance GW, O'Brien, BJ, Stoddart GL. Methods for the Evaluation of Health Care Programmes, 4th 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.
- 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. 2nd edition. Cambridge: Cambridge University Press, 2014.
- Briggs A, Sculpher M, Claxton K. Decision Modelling for Health Economic Evaluation. Oxford University Press, 2007.
- Muennig P, Bounthavong M. Cost-Effectiveness Analysis in Health: A Practical Approach, 3rd 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.
- Drummond M, McGuire A, eds. Economic Evaluation in Health Care: Merging Theory with Practice. Oxford University Press, 2001.

Analysis of costs and Healthcare Resource Utilization:

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

Treatment Effects Estimation:

- Gertler PJ, Martinez SP, Rawlings LB, Vermeersch CMJ. Impact Evaluation in Practice, 2nd edition. Washington, DC: Inter-American Development Bank and World Bank, 2016.
- Cerulli, G. Economic Evaluation of Socio-Economic Programs, Theory and Applications, in Advanced Studies in Theoretical and Applied Econometrics. Springer, Heidelberg New York, 2015.
- Khander, SR, Koolwal GB, Samad HA. Handbook on Impact Evaluation: Quantitative Methods and Practices. The World Bank: Washington, D.C., 2010.
- Angrist, JD. Pischke S. Mostly Harmless Econometrics: An Empiricists' Companion. Princeton University Press, 2009.

I. Health Economic Evaluation

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

Readings: Neumann et al., Chapter 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. 4th edition. Ottawa: CADTH; 2017.

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

TreeAge Pro Suite 2018 User's Manual, **Chapters 32-36, 38,40.** 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, Hollenbeck CS. Rates and probabilities in economic modelling: transformation, translation and appropriate application. *Pharmacoeconomics* 2007;25(1):3-6.

Spruance SL, Reid JE, Grace M, Samore M. Hazard ratio in clinical trials. *Antimicrobial Agents and Chemotherapy* 2004 Aug; 48(8):2787-92.

Moser BK, McCann MH. Reformulating the hazard ratio to enhance communication with clinical investigators. *Clinical Trials* 2008; 5(3):248-252.

Buyse M. Reformulating the hazard ratio to enhance communication with clinical investigators. *Clinical Trials* 2008; 5(6):641-642.

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

Hoyle MW, Henley W. Improved curve fits to summary survival data: application to economic evaluation of health technologies. *BMC Medical Research Methodology* 2011 Oct 10; 11:139. (**Note:** the authors supplied an excel sheet)

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)

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.

V. Treatment Effects using Observational Data:

Gertler, P.J. Martinez, SP, Rawlings, LB. Vermeersch, CMJ. Impact Evaluation in Practice, 2nd edition. Washington, DC: Inter-American Development Bank and World Bank, 2016.

Cerulli, G. Economic Evaluation of Socio-Economic Programs, Theory and Applications, in Advanced Studies in Theoretical and Applied Econometrics. Springer, Heidelberg New York, 2015.

Khander, SR, Koolwal GB, Samad HA. Handbook on Impact Evaluation: Quantitative Methods and Practices. The World Bank: Washington, D.C., 2010.

Angrist, JD. Pischke S. Mostly Harmless Econometrics: An Empiricists' Companion. Princeton University Press, 2009.

Selected 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 are allowed to 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:

- 10% - Regular class attendance, class participation and presentation
- 30% - Three Assignments: January 30th, February 27th, April 2nd (dates are subject to change)
- 20% - Mid-term Exam: March 12, 2019
- 40% - Final Research Project: April 24, 2019

Final Project:

Students in this course are required to complete a project in the area of Health Economics (Cost-effectiveness, Cost-Benefit, Cost Analysis, or Equity Analysis).

Your final project should have the following components:

- The study rationale: clinical and/or economic significance must be clearly written upfront.
- A comprehensive review of the previous literature must be provided.
- A decision-analytic model or a statistical model as your analytical framework must be used for your chosen project. You are strongly encouraged to discuss a feasible project with the instructor at the earliest opportunity.
- The model assumptions must be stated clearly and must acknowledge any limitations and its implications in the discussion section.
- Conduct relevant sensitivity analyses as relevant to your project.
- The final project report, including discussion and policy implications should be written clearly.
- The final project should be prepared in the journal article style with the detailed results & syntax provided in an Appendix and e-mail to the instructor.

Project Milestones:

Project Proposal and Literature Review **(25% weight)**: 2nd Week of February

Proposed Methodology and Analysis Plan **(20% weight)**: 2nd Week of March

Class Presentation **(10% weight)**: 1st Week of April

Final Project Report **(45% weight)**: April 24, 2019

Policy on Accommodation for Medical and Non-Medical Absences

Refer to Western's Policy on Academic Consideration for Student Absences:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf (updated as of September 1, 2019).

All non-medical absences must be approved in advance. In the case of an unexpected absence on compassionate grounds, documentation may be requested. If documentation is required by the instructor for either medical or non-medical academic accommodation, then such documentation must be submitted by the student directly to the appropriate Faculty Dean's office and not to the instructor. It will be the Dean's office that will determine if accommodation is warranted.

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.
- Graduate students:
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

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/>.

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.

Cell Phone and Electronic Device Policy

The Schulich School of Medicine & Dentistry is committed to ensuring that testing and evaluation are undertaken fairly across all our departments and programs. For all tests and exams, it is the policy of the School and the Department of Epidemiology and Biostatistics that any electronic devices, i.e., cell phones, tablets, cameras, or iPod are strictly prohibited. These devices **MUST** be left either at home or with the student's bag/jacket at the front of the room and **MUST NOT** be at the test/exam desk or in the individual's pocket.

Any student found with one of these prohibited devices will receive a grade of zero on the test or exam. Non-programmable calculators are only allowed when indicated by the instructor. The Department of Epidemiology and Biostatistics is not responsible for stolen/lost or broken devices.