

Department of Epidemiology and Biostatistics

Epidemiology 4615B/9530B Health Economic Evaluation Winter 2023

Class Times:

Tuesday: 9:30 a.m. – 11:30 a.m.

Thursday: 9:30 a.m. – 10:30 a.m.

Instructors: Sisira Sarma & Ava John-Baptiste**Office Hours:** by appointment**E-mail Ava:** ajohnbap@uwo.ca**E-mail Sisir:** ssarma2@uwo.ca**Location:** PHFM 3015**Teaching Assistant:** Steve Lee**E-mail:** hlee465@uwo.ca**Office Hours:** TBA

Course Information

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

Undergraduate Policy: Unless you have either the requisites for this course or written special permission from your Dean 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.

Graduate Policy: Enrollment in this course is restricted to graduate students in the Department of Epidemiology and Biostatistics, as well as any student that has obtained special permission to enroll in this course from the course instructor as well as the Graduate Chair (or equivalent) from the student's home program.

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. 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 cost-effectiveness analysis using TreeAge software package, 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).

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.

Software:

We will be using TreeAge Pro and STATA software packages. Students in the Department of Epidemiology and Biostatistics should have access to Stata Software. TreeAge Pro Healthcare can be purchased at: <https://www.treeage.com/product/treeage-pro-healthcare/> (choose Student Course License option, the cost of which is US\$55).

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).
- 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, 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.
- 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. 2nd edition. Cambridge: Cambridge University Press, 2014.
- 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.

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).

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.

Reading Articles

(Selected articles will be covered in the class)

Paulden. Calculating and Interpreting ICERs and Net Benefit. *PharmacoEconomics* (2020) 38:785–807.

Attema, A.E., Brouwer, W.B.F. Claxton, K. Discounting in Economic Evaluations. *PharmacoEconomics* (2018) 36:745–758.

Turner et al. Adjusting for Inflation and Currency Changes Within Health Economic Studies. *Value in Health*. 2019; 22(9):1026–1032.

Sculpher. Subgroups and Heterogeneity in Cost-Effectiveness Analysis. *PharmacoEconomics* 2008; 26 (9): 799-806.

Petrou et al. A Practical Guide to Conducting a Systematic Review and Meta-analysis of Health State Utility Values. *PharmacoEconomics* (2018) 36:1043–1061.

Hunter et al. An Educational Review of the Statistical Issues in Analysing Utility Data for Cost-Utility Analysis. *PharmacoEconomics* (2015) 33:355–366.

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. 2022. Consolidated Health Economic Evaluation Reporting Standards 2022 (CHEERS 2022) Statement: Updated Reporting Guidance for Health Economic Evaluations. Available at: <https://pubmed.ncbi.nlm.nih.gov/35031096/>

Sanders GD, Neumann PJ, Basu A, et al. Recommendations for conduct, methodological practices, and reporting of cost-effectiveness analyses: Second Panel on Cost-Effectiveness in Health and Medicine. *JAMA*. 2016;316(10):1093-1103.

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.

O’Conner et al. The impact of public investment in medical imaging technology: an interagency collaboration in evaluation. *Economics of Innovation and New Technology* 2015: 24(5), 510-531.

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 Healthcare 2021 User's Manual, Chapters 2,3, 33-37 (required), 41-45 (if time permits).
Williamstown (MA): TreeAge Software Inc.

a. Decision-analytic Models

Reading Articles

(Selected articles will be covered in the class)

- Barton et al., 2004. Modelling in the economic evaluation of health care: selecting the appropriate approach. *Journal of Health Services Research & Policy* 2004; 9(2),110–118.
- Brennan et al. A taxonomy of model structures for economic evaluation of health technologies. *Health Economics* 2006;15(12):1295-310.
- Stahl. Modelling Methods for Pharmacoeconomics and Health Technology Assessment: An Overview and Guide. *PharmacoEconomics* 2008; 26 (2): 131-148.
- 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.

Example Studies:

- Chung KC, Walters M, Greenfield ML, Chernew ME. Endoscopic versus open carpal tunnel release: a cost-effectiveness analysis. *Plastic and Reconstructive Surgery* 1998, 102(4), 1089-1099.
- Vasen AP, Neptune NJ, Kuntz KM, Simmons BP, Katz JN. Open versus endoscopic carpal tunnel release: a decision analysis. *Journal of Hand Surgery* 1999, 24A, 1109-117.

Additional journal articles may be assigned.

b. Markov Models and Microsimulation Models

Reading Articles

(Selected articles will be covered in the class)

- 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

Reading Articles

(Selected articles will be covered in the class)

- Fleurence RL, Hollenbeak CS. Rates and probabilities in economic modelling: transformation, translation and appropriate application. *PharmacoEconomics* 2007;25(1):3-6.
- O'Mahony et al. Dealing with Time in Health Economic Evaluation: Methodological Issues and Recommendations for Practice. *PharmacoEconomics* (2015) 33:1255–1268.
- Gidwani and Russell. Estimating Transition Probabilities from Published Evidence: A Tutorial for Decision Modelers. *PharmacoEconomics* (2020) 38:1153–1164.
- 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.
- Symons and Moore (2002). Hazard rate ratio and prospective epidemiological studies. *Journal of Clinical Epidemiology* 55 (2002) 893–899.

III. Analysis of Costs and Healthcare Resource Utilization:

- Deb et al.
 Glick et al., Chapters 5-6
 Jones et al., Chapters 3, 12

Reading Articles

(Selected articles will be covered in the class)

- Franklin et al. An Educational Review About Using Cost Data for the Purpose of Cost-Effectiveness Analysis. *PharmacoEconomics* (2019) 37:631–643.
- Guidance Document for the Costing of Health Care Resources in the Canadian Setting, 2nd edition. Ottawa: CADTH, 2016.
https://www.cadth.ca/sites/default/files/pdf/CP0009_CADTHCostingGuidance.pdf
- 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

Reading Articles

(Selected articles will be covered in the class)

- 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 attendance, class participation, in-class quizzes, four assignments, and a final project.

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

- 10% - Regular class attendance, occasional quizzes/presentation and class participation
- 25% - Three Assignments: February 14, 2023, March 10, 2023, April 10, 2023 (dates are subject to change)
- 25% - Mid-term Exam: March 14, 2023 (class time)
- 40% - Final Research Project: April 22, 2023

Final Project:

Students in this course are required to complete a project in the area of Health Economics (Cost-effectiveness, Cost-Benefit, or Cost 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 limitations and its implications in the discussion section.
- Conduct relevant sensitivity analyses as relevant to your project (e.g., deterministic and probabilistic sensitivity analysis for cost-effectiveness projects).

- 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: last week of February

Proposed Methodology and Analysis Plan: 3rd Week of March

Class Presentation: last week of March - 1st Week of April

Final Project Report: April 22, 2023

Western Academic Policies and Statements

Absence from Course Commitments (Graduate Policy)

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 for either medical or non-medical academic accommodation, then such documentation must be submitted by the student to the instructor.

Absence from Course Commitments (Undergraduate Policies)

A. Absence for medical illness:

Students must familiarize themselves with the [Accommodation for Illness Policy](#).

A student seeking academic accommodation for any **work worth less than 10%** must contact the instructor or follow the appropriate Department or course specific instructions provided on the course outline. Instructors will use good judgment and ensure fair treatment for all students when considering these requests. You are not required to disclose details about your situation to your instructor; documentation is not required in this situation, and you should not send any pictures to your instructor.

If you are unable to meet a course requirement for any **work worth 10% or greater** due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Academic Counseling as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. Please note that the format of a make-up test, exam, or assignment is at the discretion of the course coordinator.

A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Record's Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found at:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

B. Absence for non-medical reasons:

Student absences might also be approved for non-medical reasons such as religious holidays and compassionate situations. Please review the policy on [Accommodation for Religious Holidays](#). All non-

medical requests must be processed by Academic Counselling. Not all absences will be approved; pay attention to the academic calendar and final exam period when booking any trips.

C. Special Examinations

A Special Examination is any examination other than the regular examination, and it may be offered only with the permission of the Dean of the Faculty in which the student is registered, in consultation with the instructor and Department Chair. Permission to write a Special Examination may be given on the basis of compassionate or medical grounds with appropriate supporting documents. To provide an opportunity for students to recover from the circumstances resulting in a Special Examination, the University has implemented Special Examinations dates. These dates as well as other important information about examinations and academic standing can be found [here](#).

Statement on Academic Offences

Undergraduate Policy: Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

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

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

The following policies apply to all students:

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.

Accessibility Statement

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Accessible Education (AE) at 661-2111 x 82147 for any specific question regarding an accommodation or review the [Policy on Accommodation for Students with Disabilities](#)

Copyright and Audio/Video Recording Statement

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

Support Services

The following links provide information about support services at Western University:

[Academic Counselling \(Science and Basic Medical Sciences\)](#)

[Appeal Procedures](#)

[Registrarial Services](#)

[Student Development Services](#)

[Student Health Services](#)

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Department & Faculty Offices

The Department of Epidemiology and Biostatistics is located on the third floor of the Western Centre for Public Health & Family Medicine (PHFM) on Western University's Main Campus.

Undergraduate Students requiring academic counselling should contact 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.