EPIB 629: Knowledge Synthesis
Fall 2025

James (Jay) Brophy

2025-09-02

[PDF version]

About me	About class
james brophy	
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Location:	2001 McGill College Avenue **Room 464**
Hours: immediately after class or email me to schedule another time	Hours: Tuesday/Thursday 8:35h-9:55h
Office: Homeless (visiting faculty area)	

Course Description

EPIB 629 is a graduate level course providing a detailed description of the systematic review process, discusses the strengths and limitations of the method, including a step-by-step guidance on how to perform a systematic review, and how to critically appraise systematic reviews. Specific topics to be covered include: formulation of the review question, searching of literature, quality assessment of studies, data extraction, meta-analytic methods, and report writing. The course will extensively cover statistical issues of meta-analysis.

Eligibility

Introductory level training in epidemiology (e.g. EPIB 601) and biostatistics (e.g. EPIB 607). Specifically required is some basic familiarity with statistical coding, ideally R but Python is also acceptable (although the Python support I can provide is more limited). All others must seek the instructor's permission.

Course Format

This course will be taught predominately with in-person sessions. Rarely sessions may be delivered remotely via zoom if a guest lecturer from an outside institution is invited. Every effort will be made to provide a supportive learning environment throughout this course. While the course has been designed to maximize learning via in-person learning approach, further modifications may be required as we work our way through the semester so understanding and flexibility are important. McGill's Teaching and Learning Services offer numerous student learning resources.

Students should regularly check MyCourses for announcements, content, and other course related communication (i.e., at least twice per week). I recommend that students enable MyCourses' notification feature.

Learning Outcomes

By the end of this course, students will be able to:
• Explain the rationale for conducting a systematic review and/or meta-analysis
• Understand the role of systematic reviews and meta-analyses in the practice of evidence-based medicine and public health
• Describe the key components of a systematic review and meta-analysis
• Critically appraise published systematic reviews and meta-analyses
• Develop a protocol for a knowledge synthesis study, applying the knowledge and concepts discussed in this course
• Conduct a knowledge synthesis study

Course Content

Knowledge synthesis is critical for evidence-based clinical and public health practice. The widespread and growing application of systematic reviews and meta-analyses to key research and clinical questions makes it essential for that all health professionals can critically assess this research design and for research producers be able to conduct their own reviews. This course will provide a detailed description of the systematic review process, discuss its strengths and limitations, provide step-by-step guidance on how its performance, and how to critically appraise them. Specific topics to be covered include: formulation of the review question, searching of literature, quality assessment of studies, data extraction, meta-analytic methods, and report writing. The course will rely heavily on statistical methods that enable the synthesis of the available evidence. Statistical issues such as statistical model selection including problem sets with practical examples of fixed and random effects models, as well as examples of methods

to evaluate heterogeneity, individual patient level data, network meta-analysis and graphical and tabular data presentations will form a large part of the course.

Although each class session is 1.5 hours, there will inevitably be topics that come up that we can't fully address in class. I encourage you to use the Discussion section of MyCourses to post questions or comments there. I may also post any additional pertinent links to additional readings for those interested.

Students will be required to complete a systematic review on the topic of their choosing during the course. The goal is to consolidate the knowledge and experiences gained during this class to complete a knowledge synthesis study that can be subsequently submitted for peer-review publication.

Course materials

Given the important role that systematic reviews (SR) and meta-analyses play in healthcare research and practice, it is not suprising that many different resources are available. The McGill library has over 100 titles with systematic reviews in the title and the number on PubMed is literally uncountable.

The Cochrane Handbook for Systematic Reviews of Interventions is the most widely used reference for systematic reviews and meta-analyses. The 6th edition (2019) is available online at Cochrane Handbook. The Cochrane Handbook is a comprehensive resource that covers all aspects of conducting systematic reviews and meta-analyses, including study design, data analysis, and reporting. It is an essential reference for anyone involved in conducting or interpreting systematic reviews and meta-analyses.

Other useful Cochrane resouces can be found here.

For selected topics, this course will follow these two texts

Systematic Reviews in Health ResearchMeta-Analysis in Context (3rd edition 2022) edited by M Egger, JPT Higgins, and G Davey Smith. The text is available online at the McGill library
Systematic Reviews to Support Evidence-Based Medicine How to appraise, conduct and publish reviews(3rd Edition 2022) KS Khan, Javier Zamora. The text is available online at the McGill library

Bayesian meta-analysis is not really covered in this reference textbook. Fortunately new textbook **Bayesian Meta-Analysis: a practical introduction** by Robert Grant & Gian Luca di Tanna should be available by the fall 2025.

As no one textbook can cover all aspects of SR/MA that we will be exploring, we will also read specific published articles that will be posted on MyCourses.

Computing language

The computing language of choice for the course is `R`. There are several reasons for this choice including its open source and rich online community which means help is often only a Google away. R has become the *lingua franca* for much of the epidemiology/biostatistical universe. Currently, the CRAN package repository features 22087 R packages including over 60 dedicated to meta-analysis. The most popular packages are `meta`, `metafor`, `metagear`, *dmetar*, and `netmeta` for network metanalysis. Bayesian meta-analysis can be performed with the following packages `bayesmeta`, `RoBMA` and `brms`.

Of course, other languages such as Python can be used but the support I can provide is more limited. Stata is a popular software, but I see no reason to support a proprietary software when excellent open source options exist. Also I consider the scripting and reproducibility offered by R-Markdown / Quarto / Jupyter notebooks provides additional advantages for choosing `R` or `Python`.

Meta-analysis with R provides a comprehensive introduction to performing meta-analysis using the statistical software R and is available from the McGill library.

Evaluation

Name of Assignment	Date	% of Final Grade
In class participation	ongoing	10%
Critical appraisal of selected published article (750 word limit)	see schedule	20%
Development of a new knowledge synthesis protocol (750 word limit)	see schedule	20%
In class quiz (30 minute)		25%
Final protocol oral presentation with results (3MT format)		25%

In class participation: **Active** participation means showing up for each class *having read and engaged with any material assigned*, focusing during class discussion and being intellectually engaged;

Critical appraisal: Each student will choose a published SR /MA that they will critique with a maximum 750 word essay

Development of knowledge synthesis protocol: Students are required to submit a written outline (maximum 750 words) of a SR/MA protocol of their own choosing . This submission should include background/rationale, the objective of the study, the methods, expected outcome. More details can be found by following the PRISMA checklist which should be included as an appendix (doesn't count toward word limit)

Final oral presentation: Students will have 3 minutes or less and a single static slide to communicate their research! There will then be 5 minutes to respond to questions from the audience. (see details here)

Proposed Lecture's Schedule

Lecture number	Date	Topic
1	2025-09-02	Introductions and rationle, potentials and promise of SR
2	2025-09-04	Finding the evidence - Effective use of Ovid MEDLINE & EndNote
3	2025-09-09	The systematic reviews road map, framing the question & protocol writing
4	2025-09-11	Data extraction & assessing the quality of the literature
5	2025-09-16	Investigating and dealing with publication bias and other reporting biases
6	2025-09-18	Summarizing the evidence & interpreting the findings
7	2025-09-23	Reporting & appraisal of systematic reviews
8	2025-09-25	Effect measures
9	2025-09-30	Combining results with meta-analysis - Part 1
10	2025-10-02	Combining results with meta-analysis - Part 2
11	2025-10-07	The problem with p values
12	2025-10-09	Bayesian meta-analysis
NA	2025-10-14	Reading week
NA	2025-10-16	Reading week
13	2025-10-21	Exploring heterogeneity
14	2025-10-23	Dealing with missing data and other biases
15	2025-10-28	Individual patient level meta-analysis
16	2025-10-30	Network meta-analysis
17	2025-11-04	Dose response meta-analysis
18	2025-11-06	Systematic reviews of observational studies
19	2025-11-11	Systematic reviews of diagnostic studies
20	2025-11-13	Systematic reviews of prediction studies
21	2025-11-18	Meta-analysis of single RCTs
22	2025-11-20	Meta-analysis of genetic studies
23	2025-11-25	Systematic review of the Cochrane Database
24	2025-11-27	SR/MA for decision-making
25	2025-12-02	Protocol resentations - 4 minute rapid fire
26	2025-12-04	Quiz & wrap up

Figure 1: Proposed Lecture's Schedule

Academic Integrity

The Department of Epidemiology and Biostatistics has asked instructors to remind students of McGill University regulations regarding academic integrity and plagiarism. These are excerpted below.

Academic offences

The integrity of University academic life and of the degrees the University confers is dependent upon the honesty and soundness of the teacher- student learning relationship and, as well, that of the evaluation process. Conduct by any member of the University community that adversely affects this relationship or this process must, therefore, be considered a serious offence. McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see http://www.mcgill.ca/integrity for more information).

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples renseignements, veuillez consulter le site http://www.mcgill.ca/integrity).

Plagiarism

- **(a)** No student shall, with intent to deceive, represent the work of another person as their own in any academic writing or assignment.
- **(b)** If a student submits another's work, it will be presumed they intended to deceive unless proven otherwise.
- **(c)** No student shall contribute work to another student knowing it may be submitted as their own.

Cheating – No student shall

- **(a)** In the course of an examination, obtain or attempt to obtain information from another student or unauthorized source, or give/attempt to give information to another student.
- **(b)** Represent or attempt to represent oneself as another or have oneself represented by another in an examination or paper preparation.

- **(c)** Submit, without approval, any academic writing or project that has been or is being submitted elsewhere.
- **(d)** Submit work containing a known false statement or fabricated reference.

Language Rights

"In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded. This does not apply to courses in which acquiring proficiency in a language is one of the objectives."

« Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté (sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue). »