This course is an overview of the concepts necessary for performing systematic reviews and meta-analyses, covered in sufficient detail to enable students to conduct their own systematic reviews/meta-analyses upon completion of the course. Course content will include step-by-step instruction in how to conduct a systematic reviews and meta-analysis, including developing a focused research question, defining inclusion/exclusion criteria, developing literature search strategies, data abstraction and management, and statistical methods for meta-analysis. Additional topics covered will include how to determine when meta-analysis may be useful, choosing a meta-analytic method, study quality assessment, exploration of heterogeneity, evaluation of potential sources of bias, and presentation of results. Throughout this course you will be conducting a mini systematic review on a topic of your choice.

Course Information:
1.0 credit
Letter grading – A/B/C/F, based on assignments and in class participation
8 live sessions, Fall Term

Course Prerequisites:
Basic biostatistics course or permission of the instructors

Required Textbook (Online):

Other Recommended Books:
4. Cochrane Handbook of Diagnostic reviews: http://srdta.cochrane.org/handbook-dta-reviews

Course Requirements:
1. Throughout this course you will be conducting a mini systematic review on a topic of your choice. There will be 4 homework assignments (each covering about a quarter of the review) and two in-class presentations.
Formulate a specific research question

**Required preparation (prior to session):**
Email instructor a specific study question on the efficacy of an intervention that you would like to investigate via systematic review during this course.

**Objectives:**
1. Formulate a specific study question
2. Define specific inclusion and exclusion criteria

**Lecture:**
1. Definitions of systematic review and meta-analysis
2. Role of systematic reviews
3. What makes something a good study question (Hulley, ask colleagues on VAS scale)
4. Formulating a specific study question (PICO)
5. Why being specific matters
6. Introduction to the Cochrane Collaboration, Revman
7. Examples of questions and inclusion/exclusion criteria from Cochrane

**In class small-group exercise: Formulating a research question**
Review each student’s study question and why they are interested in that question. Form small groups and look for ways to refine the questions. Develop inclusion/exclusion criteria for at least one question per group. Report your difficulties to the whole class (15 min).

**Wrap-up**
What are the hallmarks of a good question? Introduce Revman. Look at examples question and inclusion/exclusion criteria from the Cochrane Database of Systematic Reviews.

**Homework Assignment 1:**
For homework 1, read chapter 5 of the Cochrane Handbook. Refine the study question that you have chosen for the course project. Refine your inclusion/exclusion criteria. Do a quick search on the Cochrane Database of Systematic Reviews to make see if a systematic review or protocol on your topic has already published. Download Revman. Hand in a printout of your study question and inclusion/exclusion criteria (i.e., complete all the sections in Revman up to “Search methods for identification of studies”). It’s ok to use bullets instead of paragraphs under each section.
Session 2  Conduct a systematic search

Objectives
1. Conduct an electronic search using the appropriate terms in an appropriate database
2. Download and organize references in Endnote
3. Assess studies using inclusion/exclusion criteria (homework)

Lecture:
1. Search strategies for finding articles in PubMed for systematic review
2. Other specific databases available (CENTRAL, EMBASE, etc)
3. Gray literature
4. Endnote

In-class exercise (finish at home if not done in class)
Generate a short list of keywords and subject headings to use in your search, combining the terms with the appropriate Boolean operators. At a minimum, your list should include 1 subject heading and 3-5 keywords for each concept in your topic. Run the search in, PUBMED, . Limit the search years so that no more than 200 articles are left. Export references into an Endnote file and tag them with the database name. Delete duplicates. Based on the title/abstract, pick the articles that need to be reviewed in full and place these in an endnote subfolder. Assess whether these latter articles meet inclusion/exclusion criteria using an excel spreadsheet. Use the spreadsheet provided on CourseWeb as an example. Enter your search strategy and results into Revman.

Hand in a flow sheet describing the study selection process and 3 problems you encountered during the process. Read chapter 7 (Selecting Studies and Collecting data) of the Handbook.

Wrap-up:
We will do the wrap-up at the beginning of the next session
Session 3  Assess risk of bias

Review of previous session:
Review problems you had with your search strategy

Objectives:
1. Complete a risk of bias table for studies meeting inclusion criteria
2. Determine other covariates (factors other than the ones assessed above) that may be important to collect on the eligible studies
3. Select the appropriate effect measure for your review

Lecture:
1. Approaches to assessment of risk of bias
2. Results from meta-epidemiological studies regarding risk of bias

In class exercise:
Each person will assess the risk of bias for the 2 provided articles. Determine 2 other factors that may influence study results (covariates). Complete a risk of bias table in groups of 2-3.

Wrap-up:
Discuss issues that come up with ROB assessment with class.
Types of effect measures
Use of data abstraction tables (one for dichotomous outcomes, the other for continuous outcomes)

Homework Assignment 2:
Select and complete the proper data abstraction form (download the excel files on CourseWeb) from your 10 “good articles” (pick most recent articles from the ones meeting inclusion criteria). See Cochrane Handbook chapter 7 and 8 for help. Post the completed excel forms on CourseWeb before the next session (11/15). We will use these for the in-class exercise next time.
Objectives:
1. Run a basic analysis on your own data using STATA (and/or Revman)
2. Interpret the output

Lecture:
1. Overview of commonly used meta-analytic methods
2. Random effects versus fixed effects models
3. How to choose a meta-analytic method

In class exercise: 1st pass at analyzing the data
Pool data from your 10 studies in STATA. Examine and interpret the forest plots and the figures.

Wrap-up discussion:
Discuss how to interpret your STATA output.

Homework Assignment 3 (prepare presentation for next class):
Examine your results. If there is a lot of heterogeneity between the studies, how will you deal with this? Also, think about subgroups that you would like to analyze separately (sensitivity analysis). Prepare 3 slides. The first showing your main results (Forest plot), the second showing your plan regarding heterogeneity, and the third showing any sensitivity analysis you plan to conduct. See the handbook chapter 9 for help. Be prepared to present to the group next session.
Student presentations:
Present analysis plan to class (3 minutes per person).

Objectives:
1. Refine analysis plan based on the lecture
2. Carry out sensitivity analysis and meta-regression in STATA.

Lecture:
1. Overview of approaches to exploring heterogeneity
2. Approaches to sensitivity analysis
3. Meta-regression

In class exercise:
Conduct sensitivity analysis and meta-regression on your data.

Wrap-up discussion:
Discuss how to interpret your STATA output.
Session 6  Summarizing findings

Objective:
1. Systematically evaluate the strengths and weaknesses of your results
2. Summarize this evaluation for your readers

Lecture:
3. Summary of findings table
4. GRADE criteria

In class small-group exercise:
Create a Summary of Findings Table for one person in the group. Discuss issues that come up with the class.

Wrap-up discussion:
Discuss issues with creating SOF tables.

Homework Assignment 4:
Hand in your final version of your mini systematic review (in Revman file). Chapter 4 of the Handbook describes the content that should be included in each section. Consult the other chapter as needed for questions. Prepare power-point presentation for final class with your findings.
Session 7  Critically reviewing meta-analyses

Objectives:
1. Apply the PRISMA checklist to evaluate the quality of the reporting of a published meta-analysis
2. Explain the limitations of meta-analysis
3. Explain how results from meta-analysis can be biased
4. List some common errors in meta-analysis

Lecture:
1. PRISMA statement
2. Disagreement between meta-analysis and large trials
3. Influence of how inclusion/exclusion criteria are applied, examples from the literature

In class small-group exercise:
Review the meta-analysis provided to you in small groups using the PRISMA checklist.

Wrap-up discussion:
Review common errors in meta-analysis.
How does one differentiate a “good” meta-analysis from a “bad” one?
Session 8  Presenting results

Lecture:
   1. Non-intervention meta-Analysis

Student presentations
Each student will present their findings (10 minute limit strictly enforced).