Developing a Study Idea Framework Using Students' Idea

Tutorial 02

CHL5402H — January 20, 2026

Online Materials

https://github.com/lpagalan

Agenda

- Attendance

- Check-In of Current Concepts

- Quick Review of PEOTS as a Structured Framework and Process

- Tutorial Pre-Work Presentations

- Group Exercise: Developing Study Ideas Using Students' Ideas

Learning Goals

- Develop exposure–outcome ideas into causal epidemiological studies

- Apply epidemiology study design concepts into practice

- Strengthen critical appraisal skills to evaluate epidemiological studies

Responsibilities of Epidemiologists

Epidemiologist

Biostatistician

Subject Matter Expert

Clinician

Study Coordinator

Knowledge Translation Expert

Health Policy Analyst

Community Stakeholders

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- Lead study design
- Define target and source populations and sampling frame
- Define, evaluate validity, and operationalize exposure assessment
- Define, evaluate validity, and operationalize outcome measurement
- Identify sources of bias and respective mitigation strategies
- Oversee methodologies, causal reasoning, and interpretation
- Ensure scientific validity of study results

Check-In of Current Concepts

Review

- Ceteris Paribus and **Target Trial**

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  - A hypothetical randomized trial and described how it can be emulated (i.e., closely approximated) by an observational study to address the research question.

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- Brainstorm exposure–outcome relationship

- Identify causal estimand, estimator, and estimate of interest

- Develop study design using a systematic framework (e.g. PEOTS)

PEOTS Framework

Population	Exposure	Outcome	Time	Study Design and Statistical Estimand
Target population to which the estimate applies (e.g., adults ≥65 years, Ontario population)	Exposure, risk factor, or intervention of interest (e.g., smoking, air pollution level, vaccination)	Health outcome being measured (e.g., incidence of disease, mortality, hospitalization)	Time over which the exposure is assessed or follow-up duration (e.g., 30-day mortality, 5-year incidence).	Study and the effect measure (e.g., risk ratio, odds ratio, hazard ratio; intention-to-treat vs per-protocol).
Define a study population in whom the health state/ outcome occurs. Then, define a study sample that includes the necessary range or variability in levels of exposure.	Define exactly what exposure is being measured. When is it being measured? How is it being measured? Is it a physical test, a scale, etc.? What are the units of measurement? What are you doing to minimize measurement error?	Define exactly what outcome is being measured. When is it being measured? How is it being measured? Is it a physical test, a scale, etc.? What are the units of measurement? What are you doing to minimize measurement error?	When is too early or late to capture the exposure? Think about incubation/induction periods. When can the outcome or effects be detected? How long should follow-up or the observation window be? Fixed, variable, long, short, repeated?	Choose a general study design that works for the question, and then refine the details of the study to minimize threats to the validity Is it possible to recruit and gather information needed?
• External vs. internal validity • Selection bias • Representativity and effect modification	• Positivity • Consistency • No interference	• Outcome definition and construct validity • Non-differential misclassification • Differential misclassification	• Immortal time bias • Differential loss to follow-up • Survivor bias • Competing risk	• Confounding • Over-adjustment • Under-adjustment • Misclassification bias • Missing data

PEOTS Framework

- **Mental Health:** Among university students **(P)**, daily social media use above 3 hours **(E)** is associated with higher incidence of clinically significant depression **(O)** over 2 years **(T)**, estimated as a relative risk from a prospective cohort study **(S)**.

- **Environmental Health:** Among adults living in urban areas of Beijing **(P)**, long-term exposure to $PM_{2.5}$ above 35 μg/m³ **(E)** is associated with increased incidence of ischemic heart disease (O) over 10 years **(T)**, estimated as a hazard ratio from a longitudinal cohort study **(S)**.

- **Maternal and Child Health:** Among pregnant women in their first trimester **(P)**, exposure to high air pollution **(E)** is associated with preterm birth **(O)** within the same pregnancy **(T)**, estimated as an adjusted odds ratio from a population-based cohort study **(S)**.

Tutorial Pre-Work Presentations

Exposure–Outcome Idea, Potential Causal Pathway, Inspiration

Developing Study Ideas

Group Exercise

PEOTS and Bias Exercise

- Breakout into 3 groups

- Pick one exposure–outcome pair for the group

- Assign PEOTS components to each group member

- Develop an epidemiological study as a group

- Each group will present and the remaining groups will help identify potential sources of bias and suggest mitigation strategies

- You may use Cochrane - Ch. 25 - Assessing Risk of Bias in a Non-Randomized Study as starting point

PEOTS and Bias Exercise

Population

Exposure

Outcome

Time

Study Design and Statistical Estimand