Epi-on-the-Island Summer Course An Introduction to Causal Inference 7–12 July 2025

This course provides a comprehensive foundation in causal inference for epidemiology, combining conceptual understanding with applied skills. Participants will build from the core principles of causal thinking to the construction and interpretation of directed acyclic graphs (DAGs), with emphasis on using observational data to answer causal questions. Through lectures, discussions, hands-on exercises, and participant presentations, participants will leave equipped with practical skills to apply in their own research.

Schedule

AOC: Annette O'Connor, VB: Victoria Brookes, ID: Ian Dohoo

Day 1 – Foundations of Causal Inference and DAGs

Build a conceptual foundation for causal thinking and begin using DAGs as a visual and analytical tool.

Time		Session
8:30 - 10:00	AOC	Causal questions & inference – the Potential Outcomes framework.
		Understand how we define and structure causal questions using counterfactual logic.
10:30 - 12:00	VB	Directed Acyclic Graphs (DAGs) – terminology, rules, and tools Learn DAG syntax, structure, and interpretation as a tool for clarifying assumptions.
1:00 - 2:30	AOC	DAGitty tutorial <i>Get hands-on with DAGitty software to build and explore DAGs.</i>
3:00 - 4:30	VB	Using DAGs to identify confounding <i>Learn how to spot confounding and identify appropriate adjustment</i> <i>sets.</i>

Day 2 – DAGs, Bias, and Implementation

Focus further on types of bias; develop skills linking DAGs with data structure to inform study design and analysis.

Time		Session
8:30 - 10:00	VB	Using DAGs to identify selection bias <i>Explore collider bias and selection effects using visual</i>
10:30 - 12:00	AOC	Building a DAG – practical approaches Practical strategies for constructing DAGs from research questions and background knowledge.

1:00 - 2:30	PRAC	Quartets: align your data analysis with your causal thinking A structured activity to evaluate how analysis aligns with causal intent.
3:00 - 5:00	PRAC	Quartets: Participants present their analyses Share insights and receive feedback from peers and instructors.

Day 3 – DAGs and Causal Frameworks in Action

Apply DAGs to real epidemiologic challenges.

Time		Session
8:30 - 10:00	AOC	Information bias and DAGs
		Understand how information arises and the application of DAGs in
		this context
10:30 - 12:00	AOC	CAFOs – causal attribution from observational studies
		Examine a real-world example (confined animal feeding operations
		[CAFOs]) to assess causal inference in observational studies.
1:00 - 2:30	PRAC	The CAFOs Practical
		Apply course concepts to the CAFOs case study
3:00 - 5:00	PRAC	Build a DAG (for a given causal question)
		Use a structured causal question to build your own DAG.

Day 4 – Integration and Practice

Consolidate core concepts and apply them to your own research questions.

Time		Session
8:30 - 10:00	PRAC	Participants present and compare DAGs
		Peer feedback and comparison of DAGs developed in Day 3.
10.20 12.00	ID	Introduction to mediation analysis (ID)
10.30 - 12.00		<i>Explore how to disentangle direct, indirect and total effects</i>
	All	'Famous' and key points recap:
1:00 - 2:30		PO Framework
		• Statistical vs causal associations
		• Table 2 Fallacy
		• M bias
		Simpson's Paradox
		DAG challenges and limitations
3:00 - 5:00	PRAC	Participants work on own DAGs
		Develop a DAG based on your own research question, with
		instructor guidance.

Day 5 – Synthesis and Next Steps

Showcase your work, receive feedback, and explore next steps in applying causal inference.

Time		Session
8:30 - 10:00	PRAC	Participants work on own DAGs
10:30 - 12:00	ID	Introduction to Quantitative Bias Analysis (ID) An introduction to methods for assessing and adjusting for residual bias in analysis
1:00 - 5:00	PRAC	Participants' final presentations Present your DAG and causal framework to the group. Receive constructive feedback and insights from peers and instructors.

Course Information

Course Materials

Participants will be provided with all lecture notes and a library of papers and useful websites relevant to the course.

Software

Participants should download DAGGitty (<u>https://www.dagitty.net/</u>) prior to the course. We will also use R for some practicals – we recommend R version 4.1.0 or later, with libraries ggplot2, epiR, and dplyr installed.

Course Preparation

To get the maximum value out of the course, we encourage participants to bring their own causal question to the course because we will work on these on Days 4—5.