Watch this video overview of module 5.

In this course we have discussed descriptive evidence in which researchers summarize how often outcomes or exposure occur. This information is summarized by incidence, prevalence, sensitivity, etc. We discussed predictive evidence in which researchers use statistical tests to see if certain outcomes are associated with certain exposures. Finally, in this module you will learn about cause and effect and how it’s established. We ultimately assume a causal relationship is established if an association can not be explained by chance, bias, or confounding.

Remember confounding is one of the four things that can explain a study’s findings. You will learn about confounding and how it can be controlled for in the design and analysis phases of a study. You will also learn how to detect residual confounding, which is confounding that is left over because it was not adequately controlled for in the study design or analysis. After a study is completed we like to be able to determine if the exposure caused the harmful outcome or if the treatment caused the improvement in the outcome. You will learn about causation criteria and how to determine if the results support a cause-effect relationship. Finally, you will learn about common visual representations of the results of studies.

Try to answer these questions as you work through this module:

- What effects can confounding have on the results of a study?
- How can you establish that some factor(s) caused an outcome? Or were they just risk factors?
Confounding:

- **Lecture notes**: read these [lecture notes](#) to get an overview of confounding.

- **Videos**: watch these videos for an overview of confounding:
  - [Controlling Confounding During the Design Phase of a Study](#) (6:23)
  - [Residual Confounding in Observational Studies](#) (6:07)

- **Readings**: read these for an overview of confounding:
  - Fletcher pages 8-10, 71-77
  - [An overview of confounding. Part 1: the concept and how to address it](#)
  - [Bias and causal associations in observational research](#) (section on confounding)

Causation:

- **Lecture notes**: read these [lecture notes](#) to get an overview of the cause-effect relationship.

- **Videos**: watch these videos for an overview of the cause-effect relationship:
  - [Measures of association](#) - misleading title but discusses how causality is determined in clinical epidemiology.(16:59). The meat begins at 8:08- prior to this is set up material.
  - [Determining Causality: A Review of the Bradford Hill Criteria](#) (4:15)

- **Readings**: read these for an overview of the cause-effect relationship:
  - Fletcher Chapter 12 pages 194-202
  - [Bias and causal associations in observational research](#) (section on judgment of association)
  - [Bradford Hill criteria](#)
Visual representations of data:
The most commonly used figures in studies are survival curves and forest plots. How to interpret them will be the focus of this part of the module.

- **Lecture notes:** no lecture notes for this section as the readings and videos are sufficient.

- **Videos:** watch these videos for an overview of how data is reported graphically:
  - [Interpreting hazard ratios](#) (5:00) - also discusses how to interpret a survival curve
  - [How to interpret a forest plot](#) (5:32)
  - [How to interpret a ROC curve](#) (5:26)

- **Readings:** read these for an overview of how data is reported graphically:
  - [Survival Curves: The Basics](#)
  - [A practical guideline to understanding Kaplan-Meier curves](#) (a little more advanced than the basics article)
  - [Tutorial: How to read a forest plot](#)
  - [Understanding diagnostic tests 3: receiver operating characteristic curves](#)
  - Fletcher Chapter 8 pages 114-115

**Problem set:** work through [these questions](#) to better understand this material. Feel free to use these with your students.
The whole approach to using the medical literature to answer clinical questions can be summarized by the graphic below which I adapted from Fletcher Figure 12.5. Your job as you read a paper is to determine if anything in the blue boxes is significantly impacting the results.

ASSOCIATION
SEEN IN A STUDY

Bias detected Yes  No

Chance Likely Unlikely

Confounding Yes No

TRUTH