USCOTS 2019 Birds Of a Feather (BOF):
Teaching Confounding (with Suggestions)

1. How can we teach confounding without multivariate regression?
   a. Use selection
   b. Use common ratios and named ratios: percent, percentage, rates and chance grammars
   c. Use comparisons of ratios: Introduce "likely" grammar.
   d. Use standardization. Adjust for inflation in Economics; Use a standard population in demographics
   d, Use weighted-average standardization. See the next section.

2. How can we teach students about Simpson's Paradox if they can't work problems?
   If predictor and confounder are binary and all outcomes rates are available:
   a. Use Wainer's graphical standardization (weighted-average). This allows students to work problems.
   Ref: www.statlit.org/pdf/2006SchieldSTATS.pdf

   If predictor and confounder are binary, but only margin outcome rates are available
   b. If confounder rate difference < predictor rate difference, then Simpson's paradox cannot occur.
   c. If confounder rate difference > predictor rate difference, then Simpson's paradox may occur.

3. How can we teach confounding without making our students distrustful of statistics as a discipline?
   a. No statistical test for confounding. See Pearl: http://bayes.cs.ucla.edu/BOOK-2K/ch6-2.pdf
   b. Study the history of smoking as a cause of cancer. Review Cornfield's argument with Fisher.
   c. Study Cornfield conditions: necessary conditions for confounder to nullify or reverse an association.
   See Schield (2009): Simpson's Paradox and Confounding. www.statlit.org/pdf/1999SchieldASA.pdf

4. How do we deal with causation in observational studies (Combine 4 and 5)?
   a. Effect size: The stronger the association (bigger the effect size), the more resistant to confounding.
   b. Hypothetical thinking: Examine sensitivity of an association to various kinds of influence.
   c. Study design: The more control, the more resilient to confounding (the stronger the evidence)
   Schield (ICOTS 2018): *Confounding and Cornfield*. www.statlit.org/pdf/2018-Schield-ICOTS.pdf

5. What's involved in offering Statistical Literacy?
   a. Sensitizing students see that "small changes in syntax can produce big changes in semantics).
   That small changes in wording can produce big changes in meaning.
   b. Introduce the ABC grammar of association, "between" and causation.
   c. Introduce study designs; grade them by their resilience to confounding. Schield (2018, ICOTS)
   d. Introduce the per named-ratio statistics: percent, percentage, rate and chance grammars.
   e. Introduce likely comparison of part-whole ratios.
   f. Distinguish control of (study design) from control for (comparisons, ratios, distributions and models)
   g. Introduce statistical significance using non-overlapping confidence intervals.
   h. Show how controlling for a confounder can change statistical significance.
   i. Show how a change in definitions can change statistical significance.
   j. Show how bias can change statistical significance.
   k. Goal is produce critical thinkers – not skeptics

Gaise 2016 Promotes Statistical Literacy: http://www.statlit.org/pdf/2017-Schield-SERJ.pdf
Schield publications: www.StatLit.org/Schield-Pubs.htm
See Milo Schield on ResearchGate.