Causal Inference

Statistical educators often use "statistical inference" to refer to population inference: the subject of the traditional research-methods course. Doing so may inadvertently block inquiry on causal inference involving observational studies. Moral: use population inference in place of statistical inference.

Q1. Which majors deal primarily causal inference involving observationally-based statistics?

Q2. Which are most students more interested in: population inference (small random samples) or causal inference (small samples and big data; random and non-random data)?

Q3. In a randomized clinical trial, does a statistically-significant result *imply* causation?
If not, is this differ from "correlation does not *imply* causation" in observational studies?
Are there two different definitions of imply? A mathematical one and a general one?

Q4. Statistical educators say "Correlation/association is not causation" in observational studies.
What could statistical educators say that would be more helpful?

Q5. Should statistical educators support offering a 2nd introductory statistics course dedicated primarily to causal inference involving observationally-based statistics? If not, why not?

Q6. What idea is (which ideas are) most central to understanding and evaluating causal inference based on statistical associations obtained from observational data?
A. statistical significance. B. confounding (take into account). C. Other?

Consider three statistical approaches to causal inference based on observational data:

- Rubin's causal method (imputing missing values using propensity scores)
- Pearl's SEM + path (DAG) diagrams method
- Galton's correlation methods:
    - Two factor covariation: multivariate-regression.
    - Two group comparison: Cornfield conditions.

Q7. Which method of presenting causal inference introduces all 1st year students to the most central idea(s) in observationally-based causal inference the quickest and easiest?

Statistical Literacy

Schield's StatLit publications: comparison-based causation

- All prior to 2023 organized by topic: www.Statlit.org/Schield-pubs.htm
- All by year published: https://www.researchgate.net/profile/Milo-Schield/research

Good introductory video

- **10 min. Seven Questions for Policymakers.** http://statlit.org/V/2022-Schield-IASE.mp4

Good introductory papers.

Statistical Literacy: A Short Introduction: www.StatLit.org/pdf/2010Schield-StatLit-Intro4p.pdf
Statistical Literacy and Liberal Education: www.StatLit.org/pdf/2004SchieldAACU.pdf
Quantitative Literacy & School Mathematics. www.StatLit.org/pdf/2008-Schield-QL.pdf
Association vs. Causation; Disparity vs. Discrimination. StatLit.org/pdf/2022-Schield-ICOTS.pdf

SCHIELD 2024 PRESENTATIONS/PAPERS (some with video):

#1: **Statistical Literacy: A New Course** (ISLP/IDSL)
Paper: www.researchgate.net/publication/380934232_Statistical_Literacy_A_New_Course
Video: https://www.youtube.com/watch?v=NDUw_4GFbtw

#2: **Statistical Literacy for General Education** (AACU) Paper at
www.researchgate.net/publication/381302940_Statistical_Literacy_for_General_Education

#3: **Using English to Help Students Understand Quantitative Ideas** (ATEG). www.researchgate.net
/publication/381801271_Using_English_to_Help_Students_Understand_Quantitative_Ideas

#4: **GAISE 2024 Proposal: Three Introductory Statistics Courses** (ECOTS). www.researchgate.net
/publication/381317919_GAISE_2024_Proposal_Three_Introductory_Statistics_Courses
Video: https://www.youtube.com/watch?v=BgxNHQSZoHU

Schield's Statistical Literacy Textbook Club (Fall 2023).

Weekly: 1-2 hours/Zoom meeting: 9:30 pm Eastern. No charge.
One chapter per week. Chapters 1-4, 7 and 8. Not covering the advanced materials.
Six chapters plus intro and review means eight weeks. Tuesday. Sept 10 – Oct 29.
Obtain the textbook: https://he.kendallhunt.com/product/statistical-literacy-2023-critical-thinking-about-everyday-statistics Contact Schield for Zoom URL.
1st session: Introductions. Review causal inference in observational studies. Review course goals, student and teacher learning outcomes, and textbook design constraints and requirements.
Start each chapter session with three questions: (1) What did you like or find interesting? (2) What didn't you understand? (3) What did you question or view as wrong or inappropriate?