Discussion: What the Social Sciences Can Learn from OMOP, Sentinel and Related Methodology

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National Institute of Statistical Sciences Affiliates Meetings

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NISS Affiliates Program

One goal: Foster discussion among sectors (academic, business, government) and application areas

- 1. Common ground in theory, methodology, implementation and communication
- 2. "Lessons learned;" unification in concepts and theory where warranted



This Session

Two very interesting papers: Many thanks to speakers

Goals of discussion:

- 1. Brief review of *some* statistical approaches and challenges in the social sciences and economics
- 2. A few highlights in potential applications and extensions of concepts and methods from main presentations



3. Questions for speakers and audience

Related Suggestion

- Current issues (transparency, reproducibility, "big data" controversies) are part of a broad societal reconsideration of statistical information, and attendant issues of quality and risk, defined broadly
- 2. Decades-long, very noisy
 - Consistent with patterns from other cases of "adoption and diffusion of technology"
- 3. Heartily support vigorous, thoughtful and wideranging engagement by statistical profession



I. *Some* Statistical Approaches and Challenges in the Social Sciences

- A. Natural and Symbiotic Relationship Between
 - 1. Data (sources and collection tools)
 - 2. Goals and methods for analysis and inference



- B. Some Approaches: Spectrum of Concepts and Methods, Sometimes Field-Specific
 - 1. Traditional sample surveys
 - 2. Administrative records and other forms of observational data
 - 3. Alternative data sources



C. Traditional sample surveys (e.g., Hansen et al., 1953; Cochran, 1977; Fuller, 1999; many others):

1. High degree of design control, replicability

- 2. Specification of
 - Target population(s), parameter(s)
 - Components of uncertainty considered in inference



3. Total Survey Error: An Estimator-Focused Approach:

(Estimator) – (True value)

- = (frame error)
- + (sampling error)
- + (nonresponse effects)
- + (measurement error)
- + (processing effects)

Andersen et al. (1979), Groves (1989), Weisberg (2005), Biemer (2010), Lyberg (2012), Kenett and Shmueli (2014), many others



- 4. Additional challenges (note common ground with main speakers): Quality of inference
 - a. Simple tabular reports
 - b. Model fitting (varying degrees of rigor in checks)
 - c. Highly exploratory analyses by some stakeholders
 - Temporal or spatial "trends
 - Subpopulation or predictor effects



- D. Administrative Records and Other Forms of Observational Data
 - 1. Data: Extensions of TSE models to non-survey settings, e.g.,

Biemer (2014), Davern (2007, 2009, 2010) FCSM (1980, SPWP #6), Herzog et al. (2007) Iwig et al. (2013, Data Quality Assessment Tool) IAOS (2008) Conference Proceedings Jabine and Scheuren (1985), Ord and Iglarsh, 2007), Penneck (2007), Royce (2007), Winkler (2009), Zhang (2009, 2011, 2012)



- 2. Analysis and Inference
 - a. Generally move well beyond traditional designbased approaches
 - b. Meta-analysis
 - c. Strong interest in policy analysis areas



- E. Alternative Data Sources: "Big," "Non-designed" or "Organic Data" (Groves, 2011, 2013; Couper, 2013):
 - Generated for non-statistical purposes
 - Limited (or no) "design control"
 - Often "tall and thin" = "variable poor"
 - a. Specialized admin (taxes, regulation, benefits)
 Ex: Automobile titles (transactions & tax)
 - b. Commercial transactionsEx: Subscription lists



ription lists

- c. Internal corporate files (with informed consent)Ex: Employment, wage, benefit and price files
- d. Web-scraped data on product features, prices
- e. Social media
 - Ex: Unemployment, job openings (Shapiro, 2014)
- f. Search engine results
 - Ex: Disease outbreaks (Google flu)
 - Ex: Demographics (Cressie et al., 2013)



II. Potential Applications and Extensions from Main Presentations

- A. Ryan and Madigan
 - 1. Definition of "quality of evidence"
 - Insights into potential extensions of traditional multi-dimensional definition of "survey quality" (e.g., Brackstone, 1999):
 - Qualitative (timeliness, relevance, comparability, coherence and accessibility)



- Quantitative (TSE, multiple comparisons)

- 2. Deeper consideration of operating characteristics of analysis methods, as used by stakeholders
 - a. Sensitivity to "analytic design"
 - b. Methods for "empirical calibration"
 - Extensions to account for (and assess sensitivity to) features of data sources (sample design, TSE components)



c. "Clinical characterization"

Per Brick (2011), contrast between studies focused on, respectively,

a large vector of prospective estimands (e.g., most government surveys)

or one high-priority outcome



d. "Population-level estimation"

- e. "Reframe the patient-level prediction problem"
 - Somewhat similar challenges encountered in evaluations for employment (training effects, wage rates, criminal justice, education
 - ii. Complications for social sciences:
 - Social-science predictors often less well identified, measured
 - Predictive power of models often very limited



B. Izem

- 1. "Surveillance system"
 - a. Alignment of rates for:
 - True change in population (level, proportion)
 - Detection of change



- Prospective intervention and impact thereof

- 1. "Surveillance system" (continued)
 - b. Rare outcomes: Alignment of data sources and statistical methods with specific types of rare events
 - Concentrated within subpopulation(s) that are identifiable a priori?
 - Extent to which potential "network effects" are understood a priori, or at least anticipated?



- 2. Integration of Multiple Data Sources
 - a. Motivation for data sharing
 - b. Commonality in data management
 - c. Comparability of data; possible differences in some dimensions of data quality



- Compare notes with Federal Statistical System Research Data Centers, NORC data enclave, others

- "Develop protocol and statistical analysis plans for safety queries in multidisciplinary teams across different partners"
- 4. "Prospective Monitoring Tools (PROMPT)"
- 5. Usage of electronic healthcare data
 - Lessons learned from FDA for other analyses closer to the social sciences (e.g., patient utilization, other behaviors)



- 6. Sequential looks and stopping rules
 - a. Substantive social science work
 - b. Adaptive/responsive design of survey fieldwork (per anticipated NISS workshop in 2016)



III. Questions for Speakers and Audience

Central questions:

- 1. Where do you see common ground?
- 2. Concrete steps to explore that common ground
 - Linkage with related current efforts by others
 - Prospective NISS workshop in 2016



III. Questions for Speakers and Audience

- A. Comments or follow-ups on current discussion
- B. Other areas not covered much in discussion
 - 1. Study of social-science interventions
 - 2. Meta-analysis



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