

Methods for Promoting Open Science in Social Policy Research



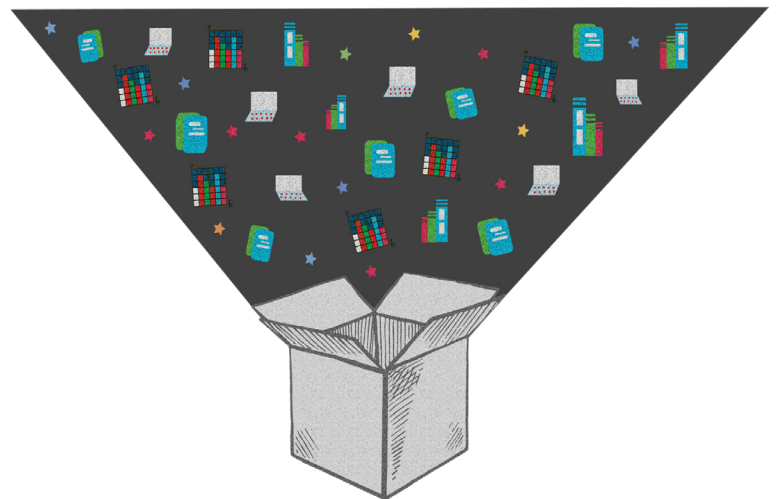
Summary of 2019 OPRE Methods Meeting

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The term “open science” describes a broad movement to make all phases of research—from design to dissemination—more transparent and accessible. The scientific community and Federal agencies that support research (including agencies overseeing policy and program evaluation efforts) have demonstrated a growing interest in open science methods. This interest stems at least partially from highly publicized news stories and journal articles that have cast doubt on research credibility.¹ These articles have highlighted issues such as data manipulation (e.g., *p*-hacking), publication bias (e.g., no publication of null results), inability to replicate or reproduce research results,² and other individual and system-level practices.³ Proponents of open science strive to transform the research ecosystem through a range of methods that encourage open sharing of research information and enable researchers to verify and build on one another’s work.⁴

As a major funder and regulator of scientific research, the Federal Government has undertaken several efforts to explore and promote open science practices. Among these efforts is the Foundations for Evidence-Based Policymaking Act of 2018 (P.L. 115–435), which aims to enhance the Government’s



¹ For example, see Hardwicke, T. E., & Ioannidis, J. P. (2018). Populating the Data Ark: An attempt to retrieve, preserve, and liberate data from the most highly-cited psychology and psychiatry articles. *PloS One*, 13(8), e0201856 and John, L. K., Loewenstein, G., & Prelec, D. (2012). Measuring the prevalence of questionable research practices with incentives for truth telling. *Psychological Science*, 23(5), 524–532.

² Winerman, L. (2017). Trends report: Psychologists embrace open science. *American Psychological Association*, 48, 90. Retrieved from <https://www.apa.org/monitor/2017/11/trends-open-science>

³ Ibid.

⁴ National Academies of Sciences, Engineering, and Medicine. (2018). *Open science by design: Realizing a vision for 21st century research*. Washington, DC: Board on Research Data and Information, Policy, and Global Affairs. Retrieved from http://sites.nationalacademies.org/pga/brdi/open_science_enterprise/

limit unforced or careless errors, detect unavoidable errors as soon as possible, and calibrate claims. The session described the importance of self-correcting science in promoting credibility and instilling trust in research findings.

Regaining public trust in research findings will require a broader communal effort to address research practices such as *p*-hacking, where researchers manipulate data to increase the likelihood of producing significant results, and HARKing, or Hypothesizing After Results are Known, wherein researchers change a hypothesis after obtaining results to draw a more compelling conclusion.

When used consistently, open science practices and quality control mechanisms can help promote a more self-correcting science. Open science strategies that can help combat errors and decrease questionable practices include (1) providing other researchers with access to data, code, materials, and notebooks to review the work; (2) pre-registering analysis plans (e.g., planned sample size, manipulations, measures, analytic strategies, critical hypothesis tests) before conducting analyses to enable research consumers to calibrate the results themselves; (3) providing open access to journals, preprints, and the peer review process to help readers from all backgrounds

“Another flaw in the human character is that everybody wants to build and nobody wants to do maintenance.”

—Kurt Vonnegut, quoted in Dr. Simine Vazire’s presentation, [*Towards a More Self-Correcting Science*](#)



better evaluate the quality of research and detect errors; and (4) declaring conflicts of interest. Mechanisms for implementing quality control include error detection (e.g., using tools like StatCheck to detect internal inconsistencies in how statistics are reported in published research papers), reproducibility testing, and replicability testing.

WHY AND HOW DO RESEARCHERS IMPLEMENT PRE-REGISTRATION PRACTICES?

Presenters shared best practices related to pre-registration, or the process of registering time-stamped, read-only study plans in a repository before beginning a research project. Pre-registering commits researchers to a specific design, hypothesis, and/or data analysis plan and aims to (1) constrain flexibility by specifying data collection and analysis decisions ahead of time, (2) increase transparency and rigor by identifying discrepancies between planned and actual study decisions, (3) promote peer review (e.g., by encouraging peer review of pre-registration plans before and after conducting a study), and (4) prevent researchers from

falsifying or manipulating their research to support a specific hypothesis. Pre-registration purposely limits changes at every stage of the study while offering researchers a reasonable amount of flexibility (e.g., ability to stop data collection, ability to adjust the level of statistical power used or the way tests are reported). Mechanisms to post pre-registered studies include internal or nonpublic systems, simple online platforms, and full-fledged registries. Throughout the meeting, presenters discussed how pre-registration can increase transparency, rigor, and/or quality while decreasing questionable research practices.

Presenters suggested several features of successful pre-registration such as creating a pre-registration template that collects standard information across studies, conducting peer reviews of plans before and after a study occurs to improve the study’s quality before it begins and check adherence to planned methods, and planning for statistical power to ensure study results are useful. Federal entities have used these kinds of techniques successfully; for example, the Office of Evaluation Sciences uses pre-registration to inform the scientific policymaking community of a study.

Presenters also discussed several myths related to pre-registration.

Pre-Registration Myth	Pre-Registration Reality
✗ Stifles creative or exploratory research	✓ Asks researchers to specify whether research is exploratory
✗ Guarantees quality and fully addresses questionable practices such as <i>p</i> -hacking	✓ Only improves quality and addresses questionable practices when done well
✗ Is irrelevant for certain types of research studies (e.g., qualitative research)	✓ Is relevant to many types of research studies and many study components
✗ Fully solves the file-drawer problem (i.e., publication bias)	✓ Only addresses publication bias if the pre-registered study is public and findable (i.e., located on a public platform or external registry)
✗ Is easy to do	✓ Is challenging to do well and requires collaboration within the broader research community
✗ Is time-consuming and expensive	✓ Can save time or add no additional time; may offset costs of errors

WHY AND HOW SHOULD RESEARCHERS PROMOTE REPRODUCIBILITY?

Reproducibility, or the process of recreating research results using the same data and methods, is critical to building scientific knowledge and credibility. Reproducing studies helps the research community confirm whether study findings are accurate and whether inferences about study results are true and generalizable. While previous generations of researchers relied largely on the prestige of their academic credentials and prior publications to establish legitimacy, the current research environment (e.g., public access to results online) enables today's researchers to be more transparent. Meeting presenters described how open science methods help researchers make reproducibility possible.

Data sharing is an essential component of reproducibility. Carefully planning and describing data management procedures at the beginning of a study and making those procedures readily searchable and accessible to others improves data quality and clearly



communicates information about the study to participants, funders, and future researchers. For example, documenting how data and code were obtained in published journal articles, using pre-registration repositories, and creating publicly accessible data files and materials can support reproducibility of findings. Federal funders and regulators can help enforce these practices by requiring contractors to adhere to specific data management processes and reviewing all materials to ensure compliance, as is done at the U.S. Department of Agriculture. Presenters noted potential resistance to making data accessible for studies that collect personally identifiable information. To address this challenge, they proposed researchers instead look for ways to release data while protecting participants from being individually identified (e.g., releasing aggregate data with redacted personally identifiable information, sharing nonconfidential information such as codebooks). While data sharing may seem to threaten the confidentiality of participants and patients, presenters also theorized the increased impact of the data would limit the necessity of future data collections and therefore reduce burden and express respect for study participants. Funders would also be satisfied with an increase in the value of the work.

HOW CAN RESEARCHERS BETTER SYNTHESIZE EVIDENCE AND BUILD THE SOCIAL POLICY EVIDENCE BASE?

Presenters discussed how open science practices can help build and synthesize social policy research evidence, including facilitating replication and meta-analyses.

Replication aims to generate the same results as previous studies using the same procedures but different data. Successfully replicating studies can help researchers strengthen and build on evidence from previous study findings. Open science practices that can facilitate replication include (1) creating transparent workflows to document the information needed for replication (e.g., lists of results to reproduce, information on original software and data, replication instructions), (2) conducting “robustness checks” before conducting a new replication study (e.g., reanalyzing original data using the original analytical strategy, verifying results are robust compared with alternative analytical choices), (3) encouraging peer review during the study design and report writing phases of a study, and (4) including open science methods in evidence clearinghouses such as the Department of Education’s What Works Clearinghouse.

Meta-analysis, or the statistical or quantitative synthesis of numerical findings from two or more studies, provides another way to build the evidence base. When implemented properly, meta-analyses generate useful evidence in social policy research by—

- ▶ Addressing some limitations of traditional narrative reviews, including reliance on *p*-values and haphazard, unsystematic, or nontransparent data collection and analysis techniques
- ▶ Increasing the statistical power to detect program effects, thereby providing more compelling evidence for policy or practice decisions than findings from any single primary study

Like other practices discussed at the methods meeting (e.g., pre-registration, reproducibility), effective implementation of replication methods requires the research community’s commitment and willingness to change current practices. Presenters described how the Federal offices responsible for funding and regulating research can help lead this shift and promote rigorous evidence building. For example, the Department of Education’s What Works Clearinghouse provides a trusted source of information on effective educational practices, and its research replication grants support systematic replication studies of interventions. While such efforts require a significant investment of time and resources for researchers, editors, peer reviewers, sponsors, and funders, they can ultimately help increase the impact of research findings.

The current scientific ecosystem is problematic. For example, academic institutions currently have a “publish or perish,” “funding or famine” perspective. Professors seeking tenure at these institutions are incentivized to write interesting articles with statistically significant findings that will be published in prestigious journals. These incentives lead to a disconnect between what is best for research (i.e., high-quality research, regardless of outcome) and what is best for the researchers (i.e., producing a copious amount of publishable results)—and result in questionable research practices.

—Summarized from Dr. Sean Grant’s presentation, *Building and synthesizing evidence: Replication*

WHAT ARE IMPORTANT CONSIDERATIONS WHEN IMPLEMENTING OPEN SCIENCE PRACTICES IN FEDERAL CONTEXTS?

A roundtable session explored best practices and challenges for implementing open science in Federal agencies. The panel opened with a discussion of the Federal Government's obligation to be a good steward of taxpayer dollars, efficiently use its limited resources, and reduce burden on the public. Openness and transparency are critical to fulfilling this obligation. The Foundations for Evidence-Based Policymaking Act of 2018 (P.L. 115–435) includes requirements that promote openness and transparency in Federal research, including public-facing annual evaluation plans, open data, and data inventories.

Next, the panelists discussed the role of open science at their respective organizations. Common practices included making data attributable and sustainable; issuing strategic plans to make data science more open; establishing systematic processes to ensure all research is sound, reliable, open, and transparent; publishing information about ongoing evaluations; and requiring contractors to adhere to specified open science practices. Panelists described their organizations' use of pre-registration, which ranged from maintaining internal applications to track analysis plans to registering studies of varying methodology in public repositories such as Open Science Framework and Clinicaltrials.gov. They noted that in addition to promoting research integrity, pre-registration requires researchers to carefully plan their methods and promotes buy-in

and feedback from stakeholders, which can prevent challenges later in the research process. Common challenges of implementing open science methods in Federal research included partners' myths and misconceptions about open science and a lack of motivation to implement open science without continuous incentives to do so.

Within the next 10 years, panelists predicted the impact of the Foundations for Evidence-Based Policymaking Act of 2018 (P.L. 115–435) will increase, and open science practices will become more common. These practices could enable higher quality and more rigorous research that effectively engages stakeholders throughout the research process. Echoing themes presented throughout the day, panelists called for a collaborative ecosystem wherein scientists, funders, patient advocacy groups, promotion and tenure committees, and repositories work together to align incentives and mutually enforce open science.

“Open science is a principle of good government.”

—Erica Zielewski, Government roundtable session

WANT TO LEARN MORE?

To access the online meeting archive, including a detailed schedule, meeting materials, and presentation slides, please visit the OPRE Methods Meeting website at <http://www.opremethodsmeeting.org>. The site also includes materials from other innovative methods meetings OPRE has organized and will be updated to include future meetings.

MEETING AGENDA

October 24, 2019, Holiday Inn Washington–Capitol, Washington, DC

Welcome

Naomi Goldstein (Office of Planning, Research, and Evaluation)

Towards a More Self-Correcting Science

Simine Vazire (University of California, Davis)

Group Exercise

Erica Zielewski (Office of Management and Budget)

Planning for Analysis and Pre-registration

Pre-registration: What and Why

Katherine Corker (Grand Valley State University)

Analysis Plans in GSA's Office of Evaluation Sciences

Ryan Moore (U.S. General Services Administration)

Reproducibility

Managing Research and Data for Reproducibility and Transparency

Margaret Levenstein (University of Michigan)

Copycat: Data Review in the Office of Policy Support

Jinee Burdug (U.S. Department of Agriculture)

Facilitator: Stuart Buck

Building and Synthesizing Evidence

Building and Synthesizing Evidence: Replication
Sean Grant (Indiana University)

Promoting Transparency and Replicability in Meta-Analysis

Emily Tanner-Smith (University of Oregon)

Synthesizing and Building Evidence of "What Works" in Education

Jonathan Jacobson (U.S. Department of Education)

Government Roundtable and Group Exercise

Panelists:

Michael Huerta (National Institutes of Health)

Jessica Lohmann (U.S. General Services Administration)

Emily Schmitt (Office of Planning, Research, and Evaluation)

David Yokum (Brown University)

Moderator:

Erica Zielewski (Office of Management and Budget)



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