



BERKELEY INITIATIVE FOR TRANSPARENCY
IN THE SOCIAL SCIENCES

Publication
Bias,
P-hacking,
and Pre-
Registration

Christensen

Introduction

Ethical
Research

Registrations

Publication Bias
P-Hacking
Registrations

Pre-Analysis
Plans

Pre-Analysis Plan

Resources

Publication Bias, P-hacking, and Pre-Registration

Garret Christensen

UC Berkeley:
Berkeley Initiative for Transparency in the Social Sciences
Berkeley Institute for Data Science

UC Davis ISS, April 2016
Slides available online at

<https://github.com/BITSS/DavisApril2016>



Outline

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ICPSR



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Ethical Research

- Transparency is part of being an ethical researcher.
- Scientific values espoused by Robert Merton (Merton 1942):
 - Universalism: anyone can make a claim regardless of status.
 - Communalism: open sharing of knowledge.
 - Disinterestedness: truth as motivation, not financial gains (COI).
 - Organized skepticism: peer review, replication.



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Ethical Research

Why we worry:

- (Anderson, Martinson, De Vries 2007)
- (John, Loewenstein, Prelec 2011)

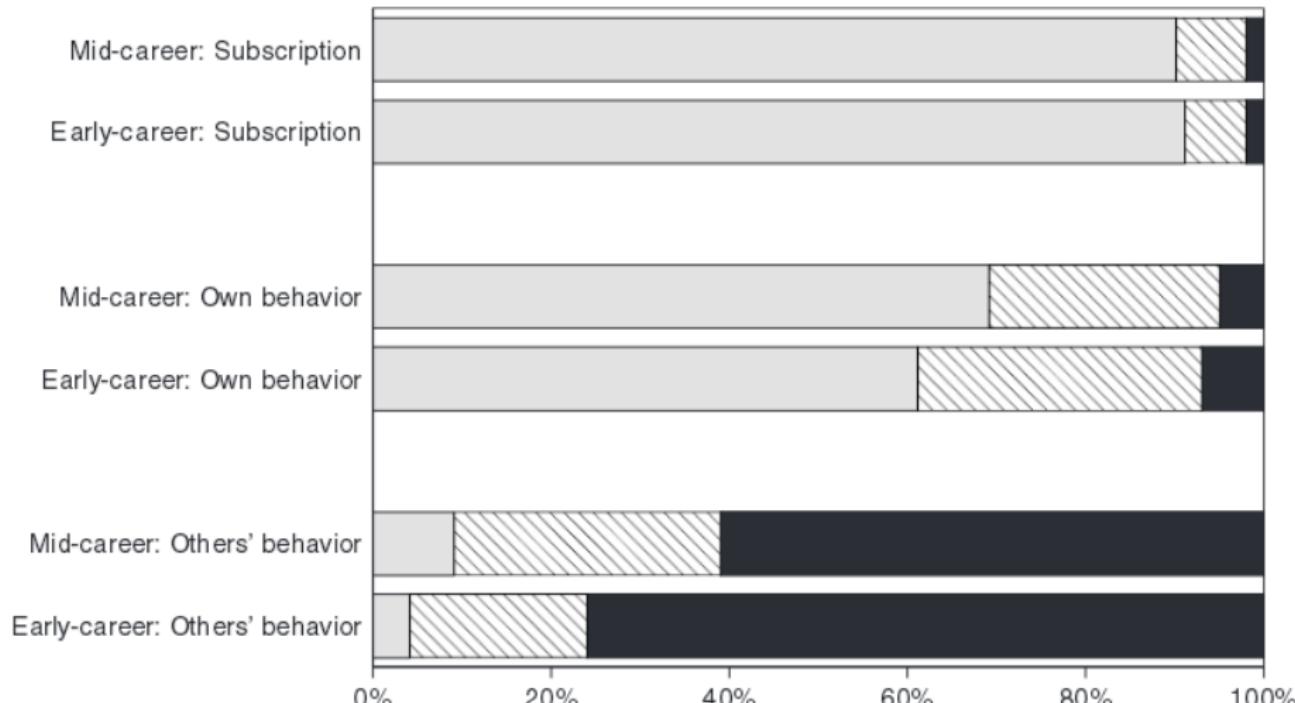


FIG. 3. Norm versus Counternorm Scores: Percent with Norm > Counternorm (dotted), Norm = Counternorm (striped), Norm < Counternorm (solid).

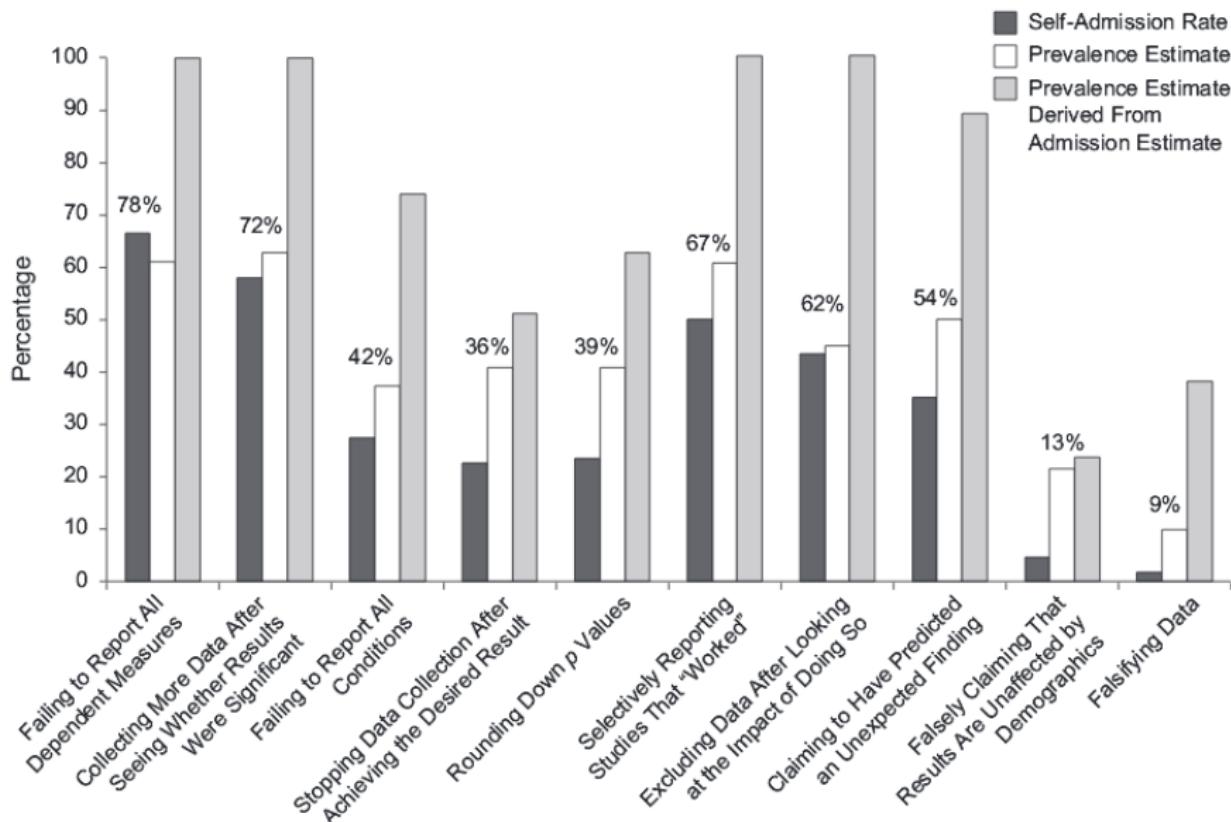


Fig. 1. Results of the Bayesian-truth-serum condition in the main study. For each of the 10 items, the graph shows the self-admission rate, prevalence estimate, prevalence estimate derived from the admission estimate (i.e., self-admission rate/admission estimate), and geometric mean of these three percentages (numbers above the bars). See Table I for the complete text of the items.



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Publication Bias

Existence of the problem:

- Effect sizes diminish with sample size (Gerber, Green, Nickerson 2001)
- There is a higher fraction of rejected hypothesis tests in social compared to hard sciences (Fanelli 2010).
- Published null results are disappearing over time, in all disciplines (Fanelli 2011).
- Data on the complete set of experiments run shows strong results are 40pp more likely to be published, and 60pp more likely to be written up. The file drawer problem is large. (Franco, Malhotra, Simonovits 2014)



All Fields

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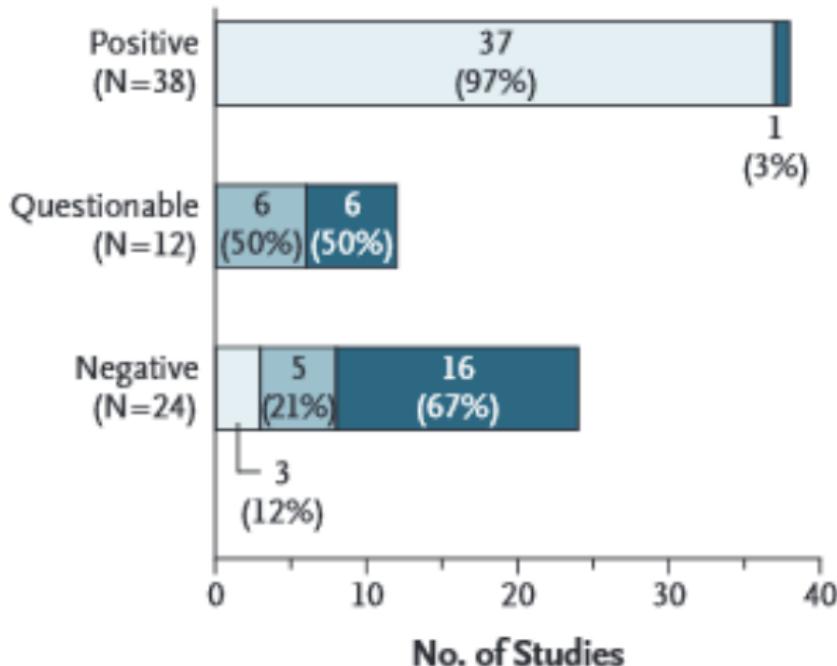
Resources

- Medicine: (Turner et al. 2008)
- Social Sciences: (Franco, Malhotra, Simonovits 2014)
- Economics: (Brodeur et al. 2016)
- Sociology: (Gerber and Malhotra 2008)
- Political Science: (Gerber and Malhotra 2008)

- Published, agrees with FDA decision
- Published, conflicts with FDA decision
- Not published

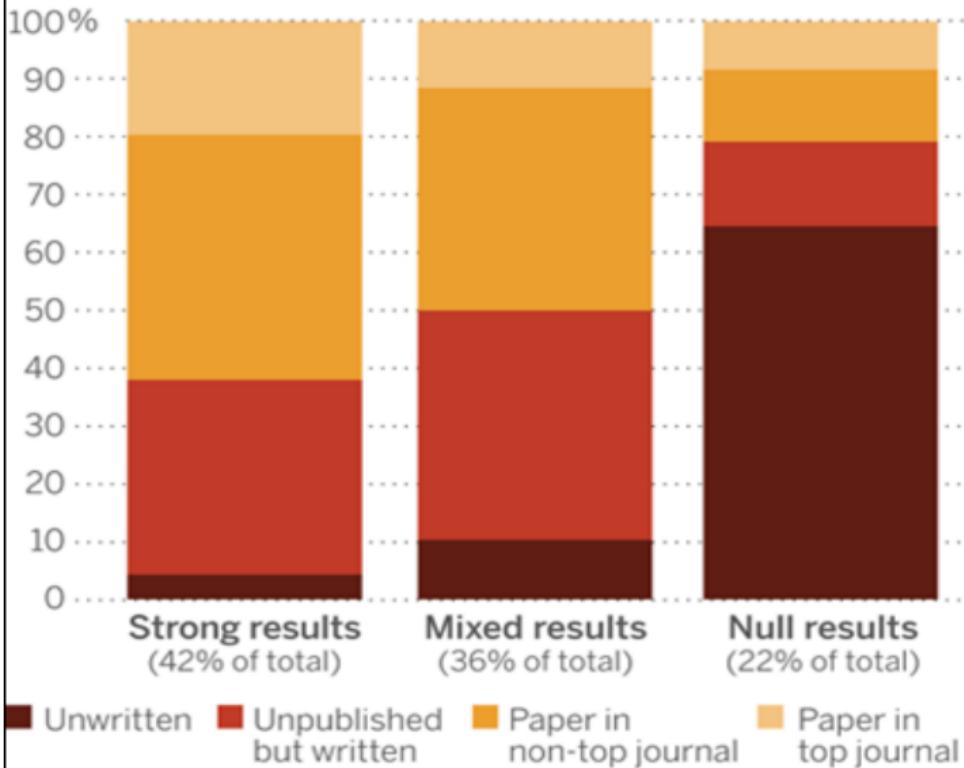
A Studies (N=74)

FDA Decision



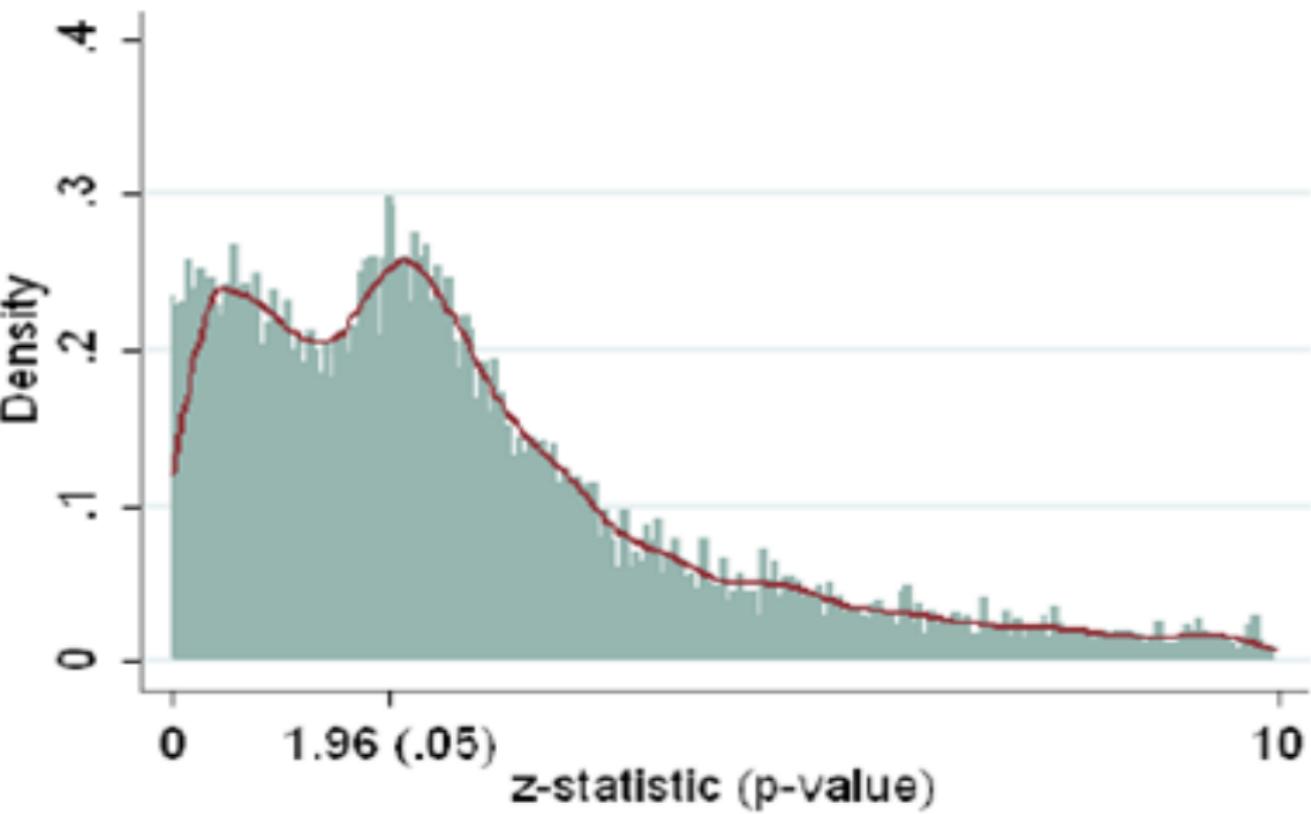
Most null results are never written up

The fate of 221 social science experiments

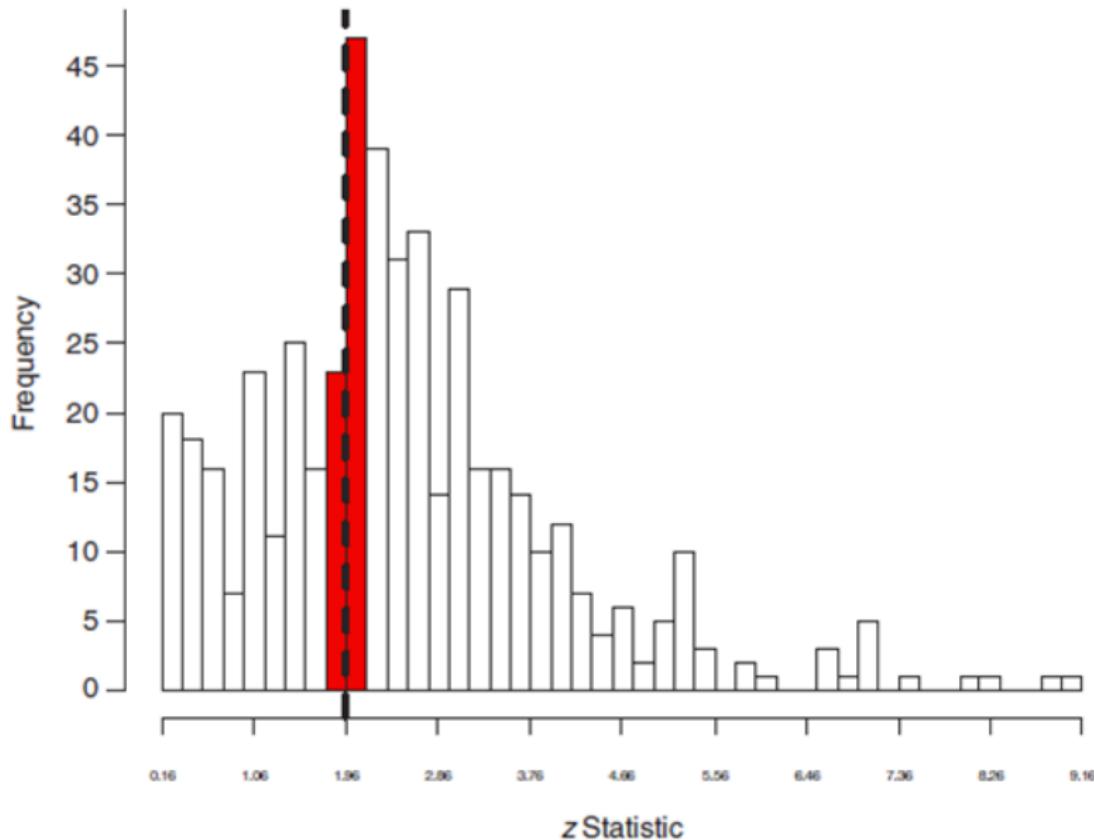


Source: A. Franco et al., *Science* (28 August)

(b) Unrounded distribution of z-statistics.



Histogram of z Statistics From the *American Sociological Review*, the *American Journal of Sociology*, and *The Sociological Quarterly* (Two-Tailed)



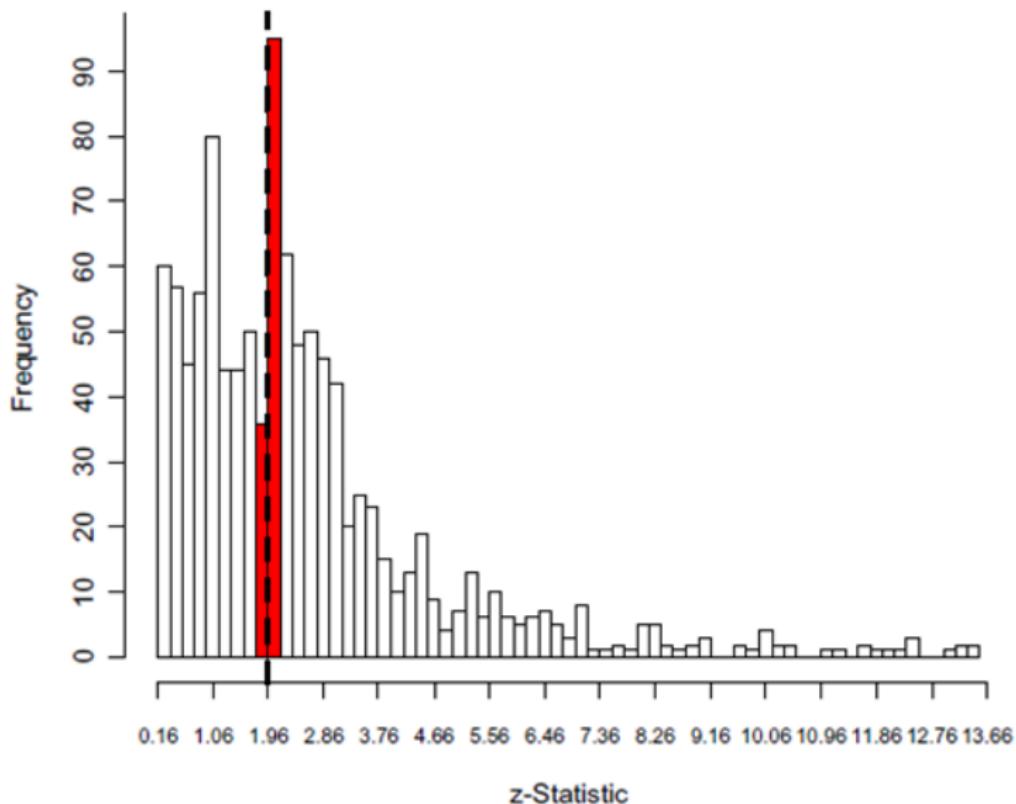


Figure 1(a). Histogram of z -statistics, *APSR* & *AJPS* (Two-Tailed). Width of bars (0.20) approximately represents 10% caliper. Dotted line represents critical z -statistic (1.96) associated with $p = 0.05$ significance level for one-tailed tests.



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If we only write up/publish significant results, and we have no record of all the insignificant results, we have no way to tell if our ‘significant’ results are real, or if they’re the 5% we should expect due to noise.



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P-Hacking

Define the problem:

- Also called fishing, researcher degrees of freedom, or data-mining.
- Definition: flexibility in data analysis allows portrayal of *anything* as below an arbitrary p-value threshold; significance loses its meaning.
- Not something only evil people do. It's subconscious, or simply built into statistics (Gelman, Loken 2013).



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P-Hacking

- “Science isn’t Broken” —538 journalism piece with interactive demo [Link](#)
- Listening to the Beatles’ “When I’m Sixty-Four” makes you younger. (Simmons, Nelson, Simonsohn 2011)
- Inordinately many .049 p-values, and indordinately few .051’s; 10-20%. (Brodeur et al 2015, “Star Wars”)
- Political ideologues literally see in black and white (Nosek, Spies, Motyl 2012)



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Registration as Solution to Publication Bias:

- Publicly stating all research you will do, what hypotheses you will test, prospectively.
- Near universal adoption in medical RCTs. Top journals (ICMJE) won't publish if it's not registered.
<http://clinicaltrials.gov>
- Even better if registry requires outcomes from after study. Currently limited, but NIH is moving on this.



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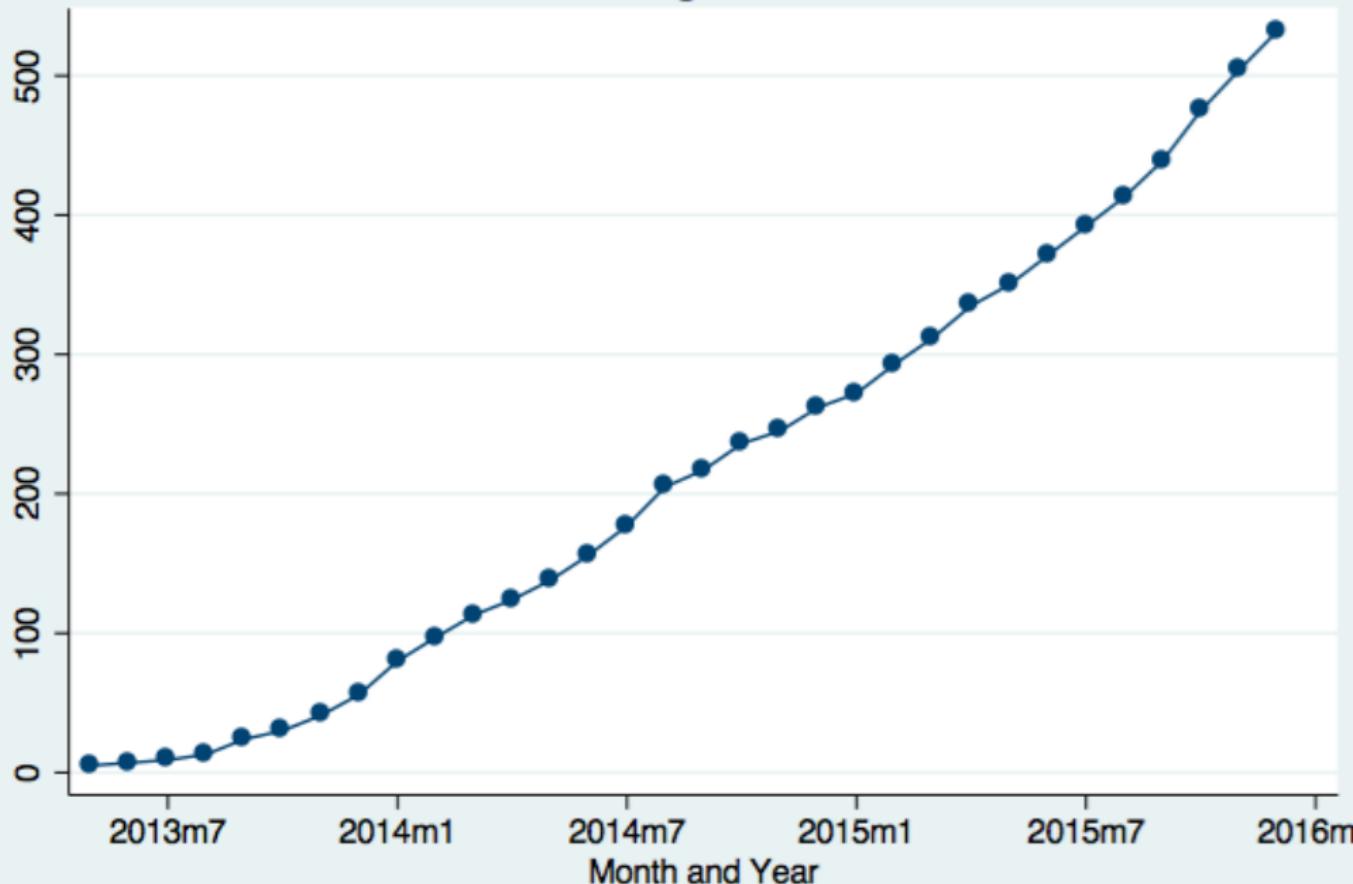
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- Newer to social sciences, but:
 - AEA registry, currently only for RCTs.
<http://socialscienceregistry.org>
 - EGAP registry
<http://egap.org/design-registration>
 - 3ie registry, for developing country evaluations.
<http://ridie.3ieimpact.org>
 - Open Science Framework
<http://osf.io>
 - Open format
 - Will soon sync with above

Total AEA Trial Registrations over Time





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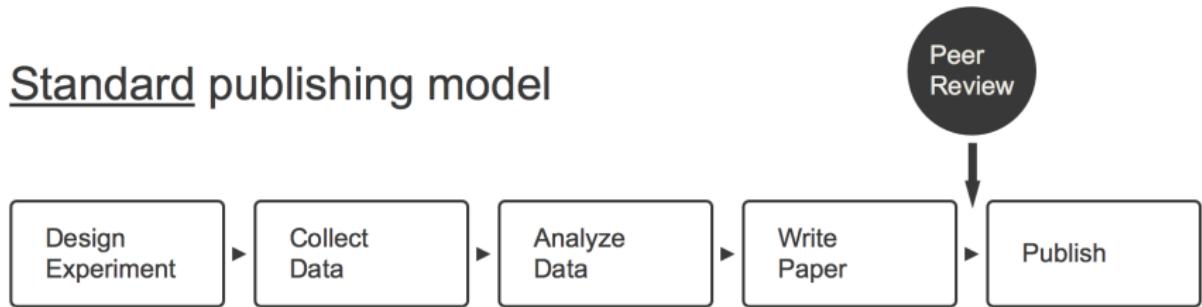
Design-Based Publication

AKA Registered Reports or Results-Blind Review, moves peer review before data gathering, results, and analysis.

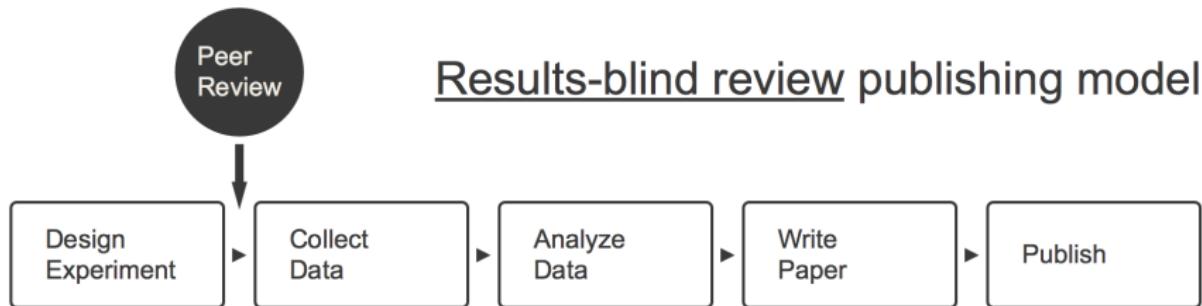
- 1 Design a project
- 2 Submit
- 3 Reviewed based on importance of question and quality of design
- 4 Get in-principle acceptance
- 5 Follow through, and nulls get published

20 Journals, 5 more with Special Issues [▶ Link](#)

Standard publishing model



Results-blind review publishing model





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Explain the solution:

- From 3ie: “A pre-analysis plan is a detailed description of the analysis to be conducted that is written in advance of seeing the data on impacts of the program being evaluated. It may specify hypotheses to be tested, variable construction, equations to be estimated, controls to be used, and other aspects of the analysis. A key function of the pre-analysis plan is to increase transparency in the research. By setting out the details in advance of what will be done and before knowing the results, the plan guards against data mining and specification searching. Researchers are encouraged to develop and upload such a plan with their study registration, but it is not required for registration.”



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Origin: FDA's Guidance for Industry

“E9 Statistical Principles for Clinical Trials” (1998) ▶ Link

§V Data Analysis Considerations

- 1 Prespecification of the Analysis
- 2 Analysis Sets
- 3 Missing Values and Outliers
- 4 Data Transformation
- 5 Estimation, Confidence Intervals, and Hypothesis Testing
- 6 Adjustment of Significance and Confidence Levels
- 7 Subgroups, Interactions, and Covariates
- 8 Integrity of Data and Computer Software Validity



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Glennerster, Takavarasha Suggestions

Running Randomized Evaluations

- 1 the main outcome measures,
- 2 which outcome measures are primary and which are secondary,
- 3 the precise composition of any families that will be used for mean effects analysis,
 - Explain mean effects, FWER, FDR using Anderson (JASA 2008).
- 4 the subgroups that will be analyzed,
- 5 the direction of expected impact if we want to use a one-sided test, and
- 6 the primary specification to be used for the analysis.



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McKenzie Suggestions

World Bank Development Impact Blog

- 1 Description of the sample to be used in the study
- 2 Key data sources
- 3 Hypotheses to be tested throughout the causal chain
- 4 Specify how variables will be constructed
- 5 Specify the treatment effect equation to be estimated
- 6 What is the plan for how to deal with multiple outcomes and multiple hypothesis testing?
- 7 Procedures to be used for addressing survey attrition
- 8 How will the study deal with outcomes with limited variation?
- 9 If you are going to be testing a model, include the model
- 10 Remember to archive it

Examples

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- J-PAL Hypothesis Registry (11)
Published papers:

- Sierra Leone CDD, Oregon Medicare, Turkey Job Training, El Salvador TOMS, two in Indonesia (Olken et al.)
- Psychology: Hawkins, Fitzgerald, Nosek—Conception Risk and Prejudice
- Search AEA or EGAP Registry

Wide range of when exactly to write and how detailed to make the plan. At the extreme level of detail you would have your entire code already written before you got any data.



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PAP–GoBifo in Sierra Leone

Casey, Glennerster, Miguel, "Reshaping Institutions:
Evidence on Aid Impacts Using a Pre-Analysis Plan" *QJE*
2012. (Paper,Plan)

- Government-sponsored program. (Vested interest in outcome—see Toms shoe company.)
- Broad program (Community Driven Development)
- Broad outcomes (trust, public goods, public services, community groups, information, participation, crime, welfare, attitudes)

Outcome variable	(1) Mean for controls	(2) Treatment effect
Panel A: GoBifo “weakened” institutions		
Attended meeting to decide what to do with the tarp	0.81	-0.04 ⁺
Everybody had equal say in deciding how to use the tarp	0.51	-0.11 ⁺
Community used the tarp (verified by physical assessment)	0.90	-0.08 ⁺
Community can show research team the tarp	0.84	-0.12*
Respondent would like to be a member of the VDC	0.36	-0.04*
Respondent voted in the local government election (2008)	0.85	-0.04*
Panel B: GoBifo “strengthened” institutions		
Community teachers have been trained	0.47	0.12 ⁺
Respondent is a member of a women’s group	0.24	0.06**
Someone took minutes at the most recent community meeting	0.30	0.14*
Building materials stored in a public place when not in use	0.13	0.25*
Chiefdom official did not have the most influence over tarp use	0.54	0.06*
Respondent agrees with “Responsible young people can be good leaders” and not “Only older people are mature enough to be leaders”	0.76	0.04*
Correctly able to name the year of the next general elections	0.19	0.04*



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PAP–Observational Studies

- Debated in public health/epidemiology.
- Difficult, but not impossible, to verifiably pre-specify.
- Example: Government data releases
- Example: Minimum Wage (Neumark 2001)

The Employment Effects of Minimum Wages: Evidence from a Prespecified Research Design

DAVID NEUMARK*

This article presents evidence on the employment effects of recent minimum wage increases from a prespecified research design that entailed committing to a detailed set of statistical analyses prior to “going to” the data. The limited data to which the prespecified research design can be applied may preclude finding many significant effects. Nonetheless, the evidence is most consistent with disemployment effects of minimum wages for younger, less-skilled workers.



Why?

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- It's good science; you can distinguish between confirmatory and exploratory analysis.
- You get a badge.
 - Project Page. [Link](#)
 - Fertile women aren't more racist (Hawkins, Fitzgerald, Nosek 2015).
- You get \$1000. [Link](#)



THE PREREGISTRATION CHALLENGE

Learn more at cos.io/prereg



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Questions?

Thank you!

Please see <http://bitss.org> for funding opportunities,
student workshops, and more.



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Extra BITSS links



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OK, I'm convinced. How do I implement this in my own research?

- Read the manual I wrote. [▶ Link](#)
- Subscribe to the BITSS blog & E-mail list [▶ Link](#)
- Apply for our Summer Institute. [▶ Link](#)
- Apply for our SSMART Grants (extra funding for developing country researchers). [▶ Link](#)
- Apply for our Leamer-Rosenthal Prizes. [▶ Link](#)

Summer Institute

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Three days of training in June at UC Berkeley, or two days of training in July at the University of Michigan.



SSMART Grant

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Up to \$30,000 grant for a research project on:

- Develop new methodology
- New tools and approaches for meta-analysis
- Research on researchers and adoption of new norms

Extra funding source for researchers from developing countries.



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Leamer-Rosenthal Prizes

Up to \$10,000 prize for completed transparent research in the social sciences, especially:

- Economics
- Political Science
- Psychology



Edward Leamer



Robert Rosenthal