Registration and Pre-Analysis Plans

Making research more transparent and reproducible

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Outline

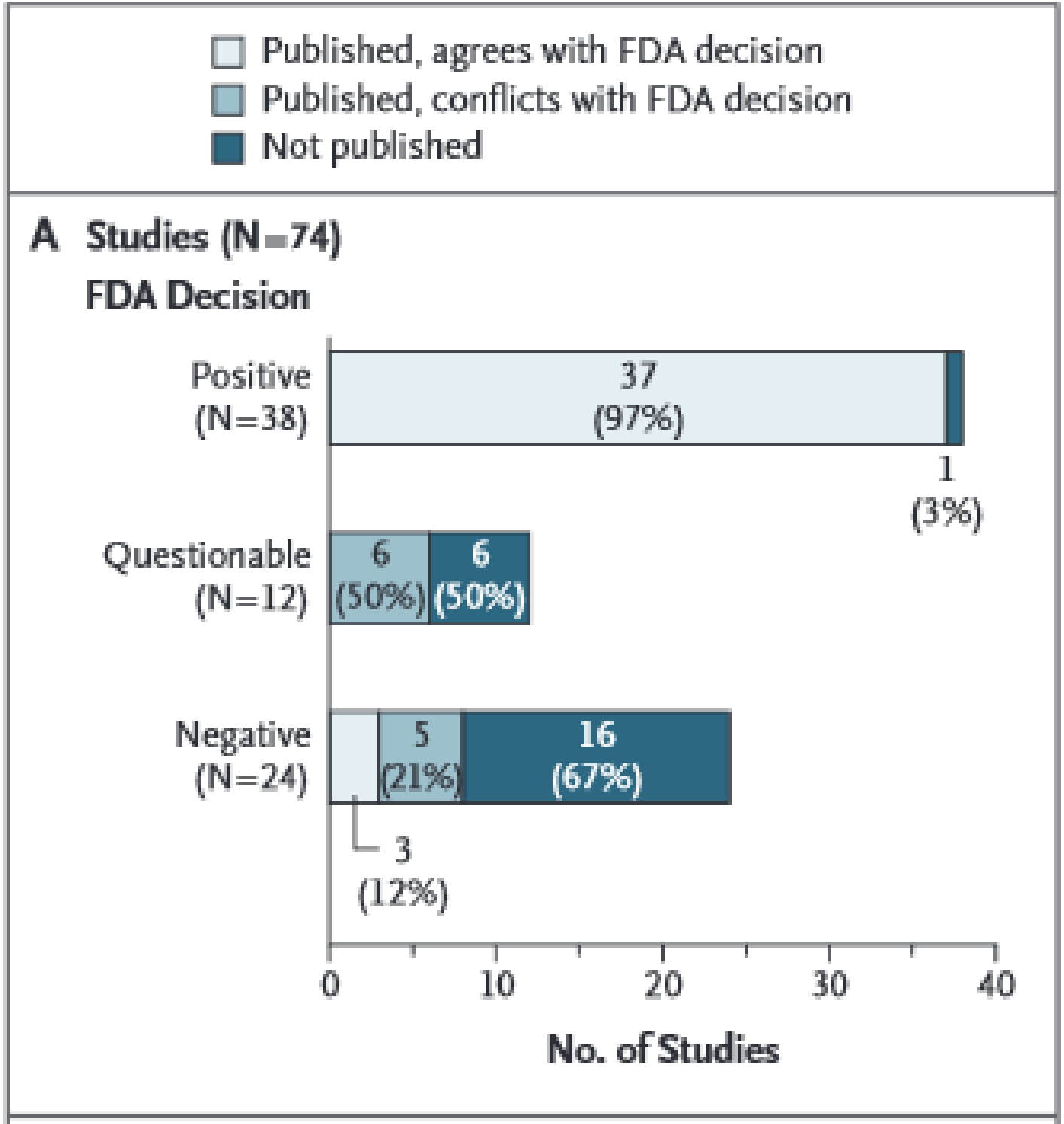
Overview

- Publication bias is a problem.
- Registration can help with publication bias.
- P-hacking/specification searching is a problem.
- Pre-analysis plans can help with specification searching.
- What should we include in our PAP, and where should we post it?

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)


Published, agrees with FDA decision
Published, conflicts with FDA decision
Not published
A Studies (N=74)
FDA Decision
Positive (N=38)
37 (97%)
1 (3%)
Questionable (N=12)
6 (50%)
6 (50%)
Negative (N=24)
5 (21%)
16 (67%)
3 (12%)
0
10
20
30
40
No. of Studies

Publication Bias

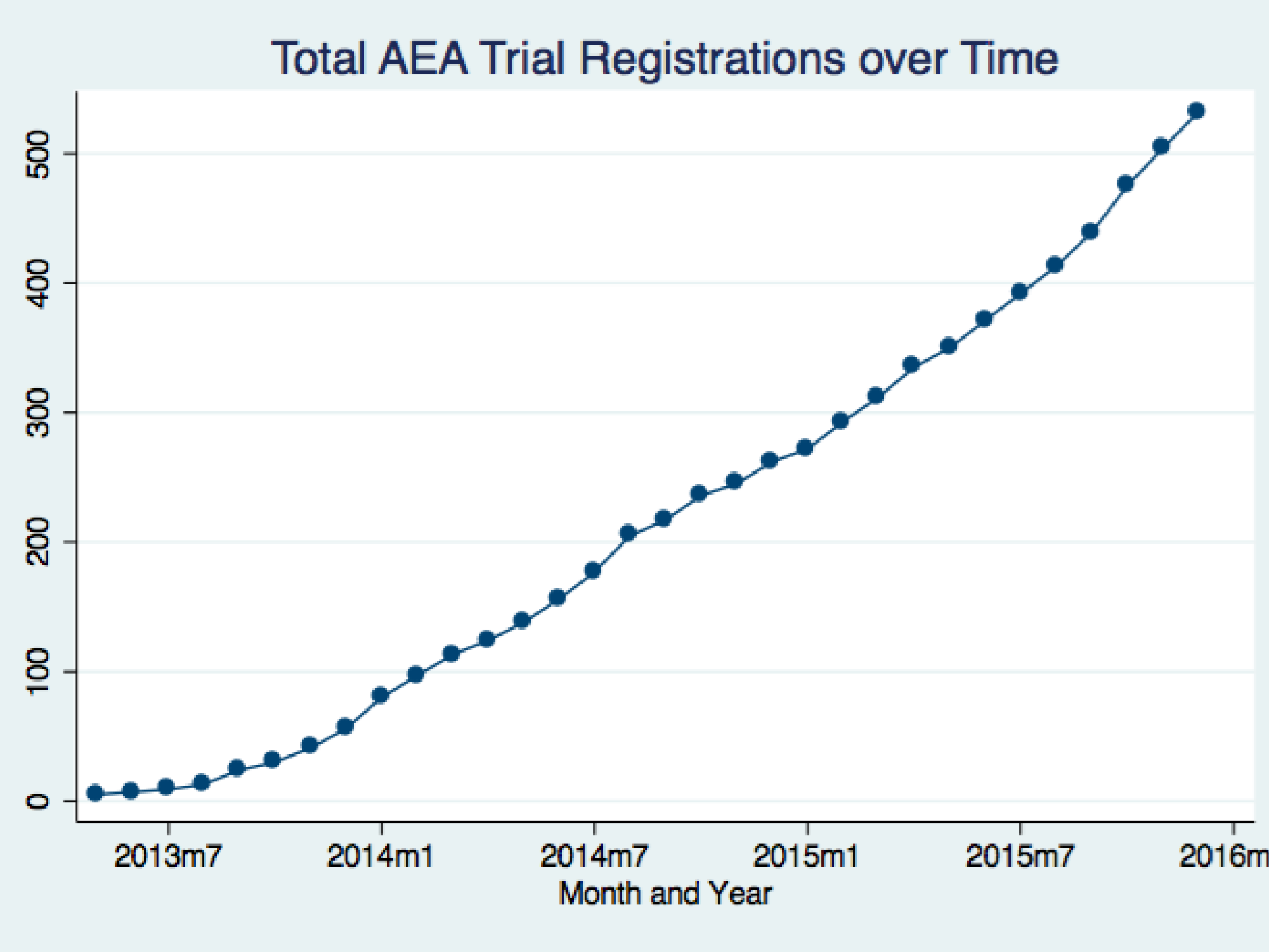
If we only write up/publish significant results, and we have no record of all the insignificant results, we have no way to tell if our 'significant' results are real, or if they're the 5% we should expect due to noise.

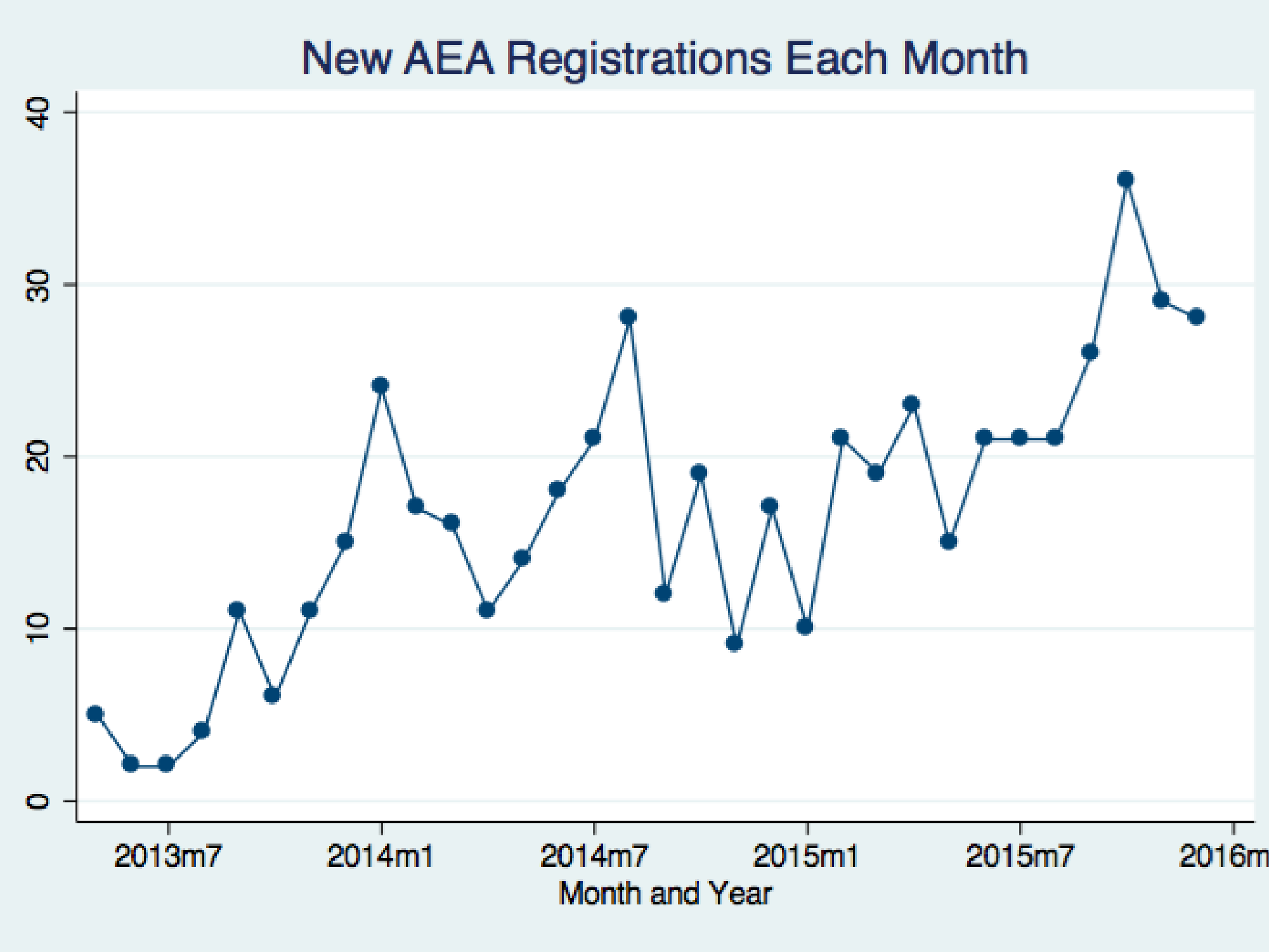
Registrations-Medicine

- Publicly stating all research you will do, and what hypotheses you will test, prospectively.
- Store this statement in a public registry.
- Near universal adoption in medical RCTs. Top journals (ICMJE) won't publish if it's not registered.
- Largest: `http://clinicaltrials.gov`
- Even better if registry requires registering outcomes after study. Currently limited, and poor compliance (Anderson et al. 2015) but NIH is moving on this. Link

Registrations-Social Sciences

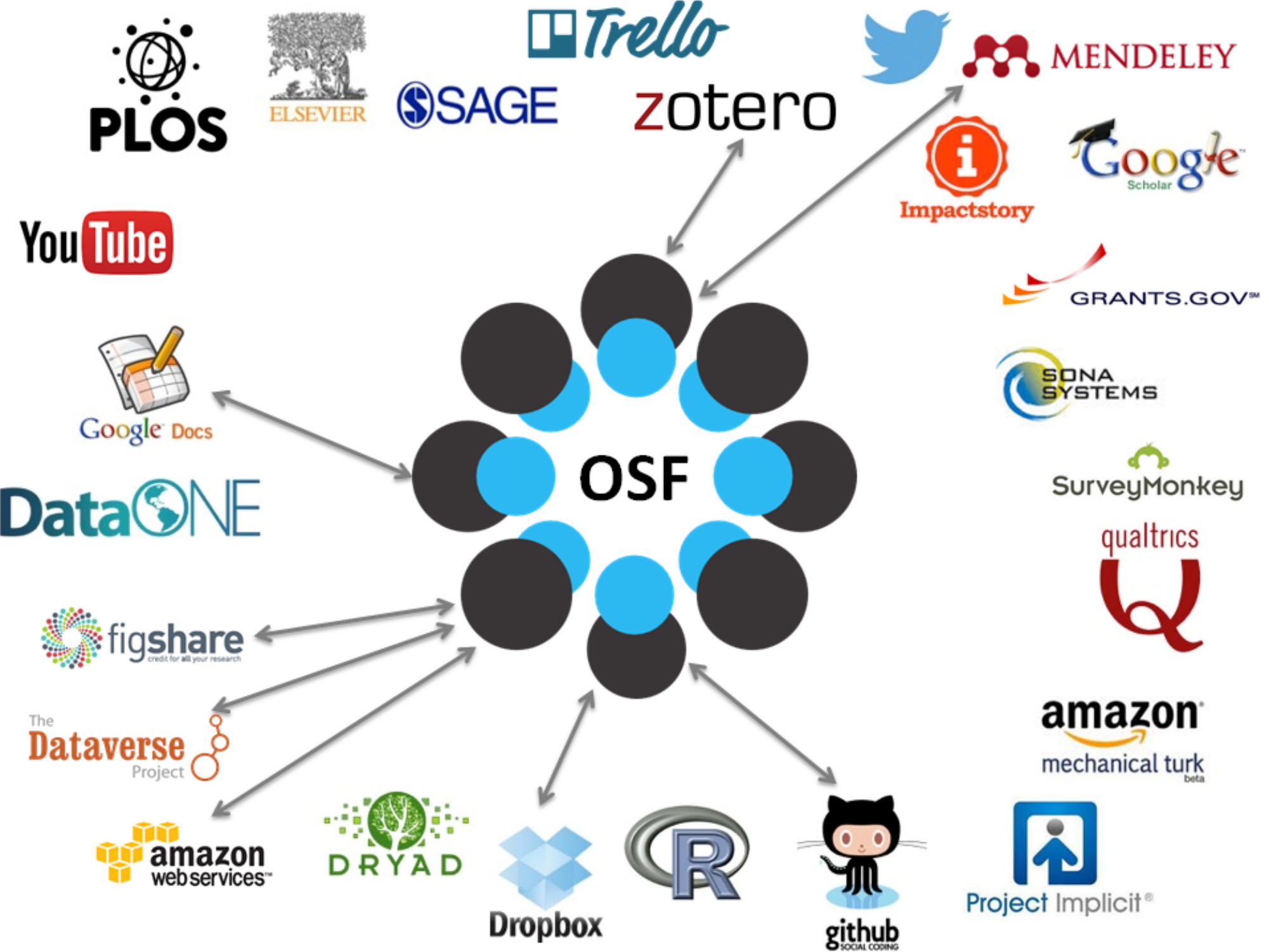
- Newer to social sciences, but good locations for several fields.
- AEA registry, currently only for RCTs.
  `http://socialscienceregistry.org`
- "J-PAL supports the American Economic Association's (AEA) registry for randomized controlled trials in economics (http://socialscienceregistry.org). It is a free, easy-to-use database that makes access to trial results more transparent, aims to address the growing number of requests for registration by funders and referees, and helps solve the problem of publication bias by providing a single place where all trials are registered in advance of their start. As of May 31, 2015, the AEA Registry had a total of 379 registered controlled trials in 70 different countries. See how the registry continues to grow below."


Total AEA Trial Registrations over Time
0
100
200
300
400
500
2013m7
2014m1
2014m7
2015m1
2015m7
2016m
Month and Year


New AEA Registrations Each Month
0
10
20
30
40
2013m7
2014m1
2014m7
2015m1
2015m7
2016m
Month and Year

Registrations-Social Sciences

- 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
  - Version Control!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MENDELEY
Impactstory
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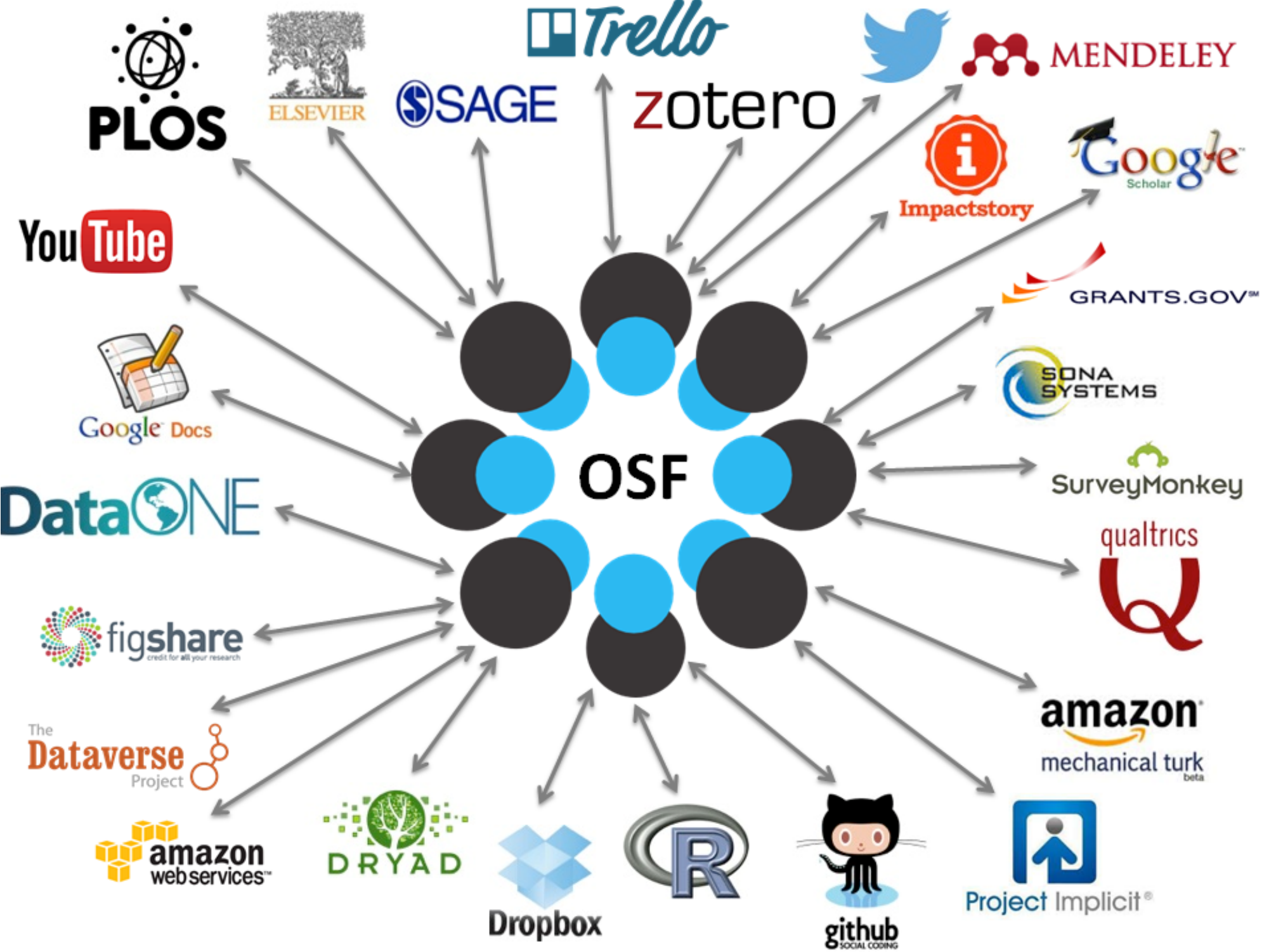
YouTube
GRANTS.GOV
Google Docs
SONA SYSTEMS
OSF
DataONE
SurveyMonkey
qualtrics
figshare
credit for all your research
The Dataverse Project
amazon mechanical turk beta
amazon web services
DRYAD
Dropbox
github SOCIAL CODING
Project Implicit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YouTube
GRANTS.GOV
Google Docs
SONA SYSTEMS
OSF
DataONE
SurveyMonkey
qualtrics
figshare
credit for all your research
amazon mechanical turk beta
The Dataverse Project
amazon web services
DRYAD
Dropbox
github SOCIAL CODING
Project Implicit

P-Hacking

- Also called fishing, researcher degrees of freedom, data mining, data massaging, data dredging, or specification searching.
- Definition: flexibility in data analysis allows portrayal of *anything* as below an arbitrary p-value threshhold; significance loses its meaning.
- Not something only evil people do. It can be subconcious—humans are really good at motivated reasoning.
- Not just that, we make completely reasonable but data-dependent decisions (Gelman, Loken 2013/2014 “Garden of Forking Paths”)

P-Hacking

Do people actually do this? (John, Loewenstein, Prelec 2011)

1. In a paper, failing to report all of a study's dependent measures
2. Deciding whether to collect more data after looking to see whether the results were significant
3. In a paper, failing to report all of a study's conditions
4. Stopping collecting data earlier than planned because one found the result that one had been looking for
5. In a paper, "rounding off" a *p* value (e.g., reporting that a *p* value of .054 is less than .05)
6. In a paper, selectively reporting studies that "worked"
7. Deciding whether to exclude data after looking at the impact of doing so on the results
8. In a paper, reporting an unexpected finding as having been predicted from the start
9. In a paper, claiming that results are unaffected by demographic variables (e.g., gender) when one is actually unsure (or knows that they do)
10. Falsifying data

1. In a paper, failing to report all of a study's dependent measures	63.4
2. Deciding whether to collect more data after looking to see whether the results were significant	55.9
3. In a paper, failing to report all of a study's conditions	27.7
4. Stopping collecting data earlier than planned because one found the result that one had been looking for	15.6
5. In a paper, "rounding off" a *p* value (e.g., reporting that a *p* value of .054 is less than .05)	22.0
6. In a paper, selectively reporting studies that "worked"	45.8
7. Deciding whether to exclude data after looking at the impact of doing so on the results	38.2
8. In a paper, reporting an unexpected finding as having been predicted from the start	27.0
9. In a paper, claiming that results are unaffected by demographic variables (e.g., gender) when one is actually unsure (or knows that they do)	3.0
10. Falsifying data	0.6

	Admission rate	Defensibility rate
1. In a paper, failing to report all of a study's dependent measures	63.4	1.84 (0.39)
2. Deciding whether to collect more data after looking to see whether the results were significant	55.9	1.79 (0.44)
3. In a paper, failing to report all of a study's conditions	27.7	1.77 (0.49)
4. Stopping collecting data earlier than planned because one found the result that one had been looking for	15.6	1.76 (0.48)
5. In a paper, "rounding off" a *p* value (e.g., reporting that a *p* value of .054 is less than .05)	22.0	1.68 (0.57)
6. In a paper, selectively reporting studies that "worked"	45.8	1.66 (0.53)
7. Deciding whether to exclude data after looking at the impact of doing so on the results	38.2	1.61 (0.59)
8. In a paper, reporting an unexpected finding as having been predicted from the start	27.0	1.50 (0.60)
9. In a paper, claiming that results are unaffected by demographic variables (e.g., gender) when one is actually unsure (or knows that they do)	3.0	1.32 (0.60)
10. Falsifying data	0.6	0.16 (0.38)

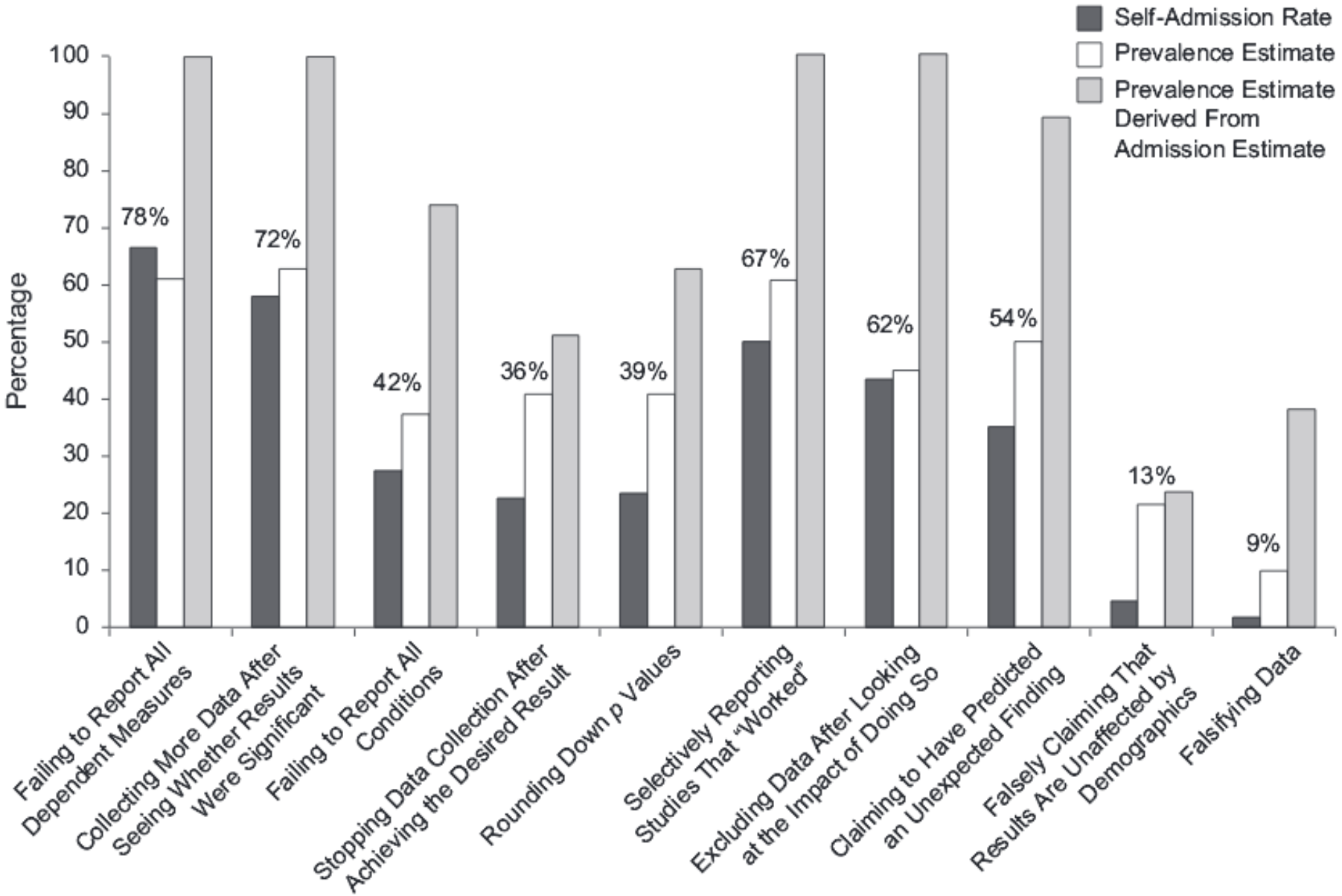

Fig. 1. Results of the Bayesian-truth-serum condition in the main study. For each of the 10 items, the graph shows the self-admission rate, prevalence estimate, prevalence estimate derived from the admission estimate (i.e., self-admission rate/admission estimate), and geometric mean of these three percentages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

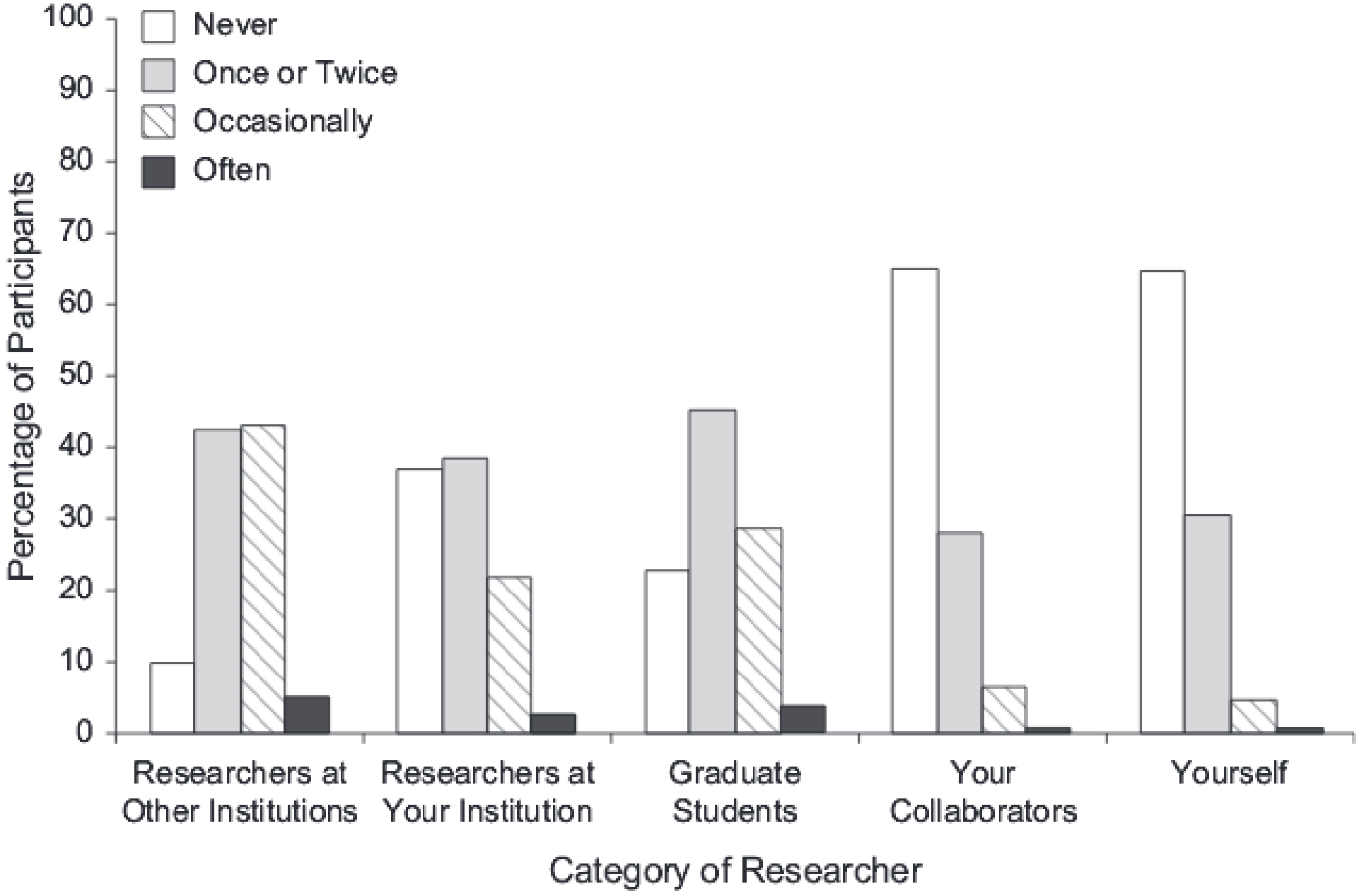

Fig. 2. Results of the main study: distribution of responses to a question asking about doubts concerning the integrity of the research conducted by various categories of researchers.

P-Hacking

- 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)

P-Hacking is fun!

- "Science isn't Broken" —538 journalism piece with interactive demo Link
- Train your p-hacking skills R/Shiny App. Link
- An Exact Fishy Test Link

Pre-Analysis Plan

- Often part of a registration
- 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

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,
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.

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

Simmons, Nelson, Simonsohn (2011)

Reporting standards, but related.

1. Authors must decide the rule for terminating data collection before data collection begins and report this rule in the article.
2. Authors must collect at least 20 observations per cell or else provide a compelling cost-of-data-collection justification. (Update: More!)
3. Authors must list all variables collected in a study.
4. Authors must report all experimental conditions, including failed manipulations.
5. If observations are eliminated, authors must also report what the statistical results are if those observations are included.
6. If an analysis includes a covariate, authors must report the statistical results of the analysis without the covariate.

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Examples

Wide range of when 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.

- J-PAL Hypothesis Registry (11), see `http://www.povertyactionlab.org/Hypothesis-Registry`
- AEA Registry has relatively few, plentiful in EGAP.
- Casey, Glennerster, Miguel, "Reshaping Institutions: Evidence on Aid Impacts Using a Pre-Analysis Plan" *QJE* 2012. (Paper,Plan)
  - Government-sponsored program.
  - Broad program (Community Driven Development)
  - Broad outcomes (trust, public goods, public services, community groups, information, participation, crime, welfare, attitudes)

RESHAPING INSTITUTIONS: EVIDENCE ON AID IMPACTS USING A PREANALYSIS PLAN*

KATHERINE CASEY
RACHEL GLENNERSTER
EDWARD MIGUEL

Despite their importance, there is limited evidence on how institutions can be strengthened. Evaluating the effects of specific reforms is complicated by the lack of exogenous variation in institutions, the difficulty of measuring institutional performance, and the temptation to "cherry pick" estimates from among the large number of indicators required to capture this multifaceted subject. We evaluate one attempt to make local institutions more democratic and egalitarian by imposing participation requirements for marginalized groups (including women) and test for learning-by-doing effects. We exploit the random assignment of a governance program in Sierra Leone, develop innovative real-world outcome measures, and use a preanalysis plan (PAP) to bind our hands against data mining. The intervention studied is a "community-driven development" program, which has become a popular strategy for foreign aid donors. We find positive short-run effects on local public goods and economic outcomes, but no evidence for sustained impacts on collective action, decision making, or the involvement of marginalized groups, suggesting that the intervention

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*

PAP Discussion

- Olken 2015: Promise and Perils—Useful when there's a vested interest.
- Niederle & Coffman 2015: Replication—Useful when replication isn't easy.

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

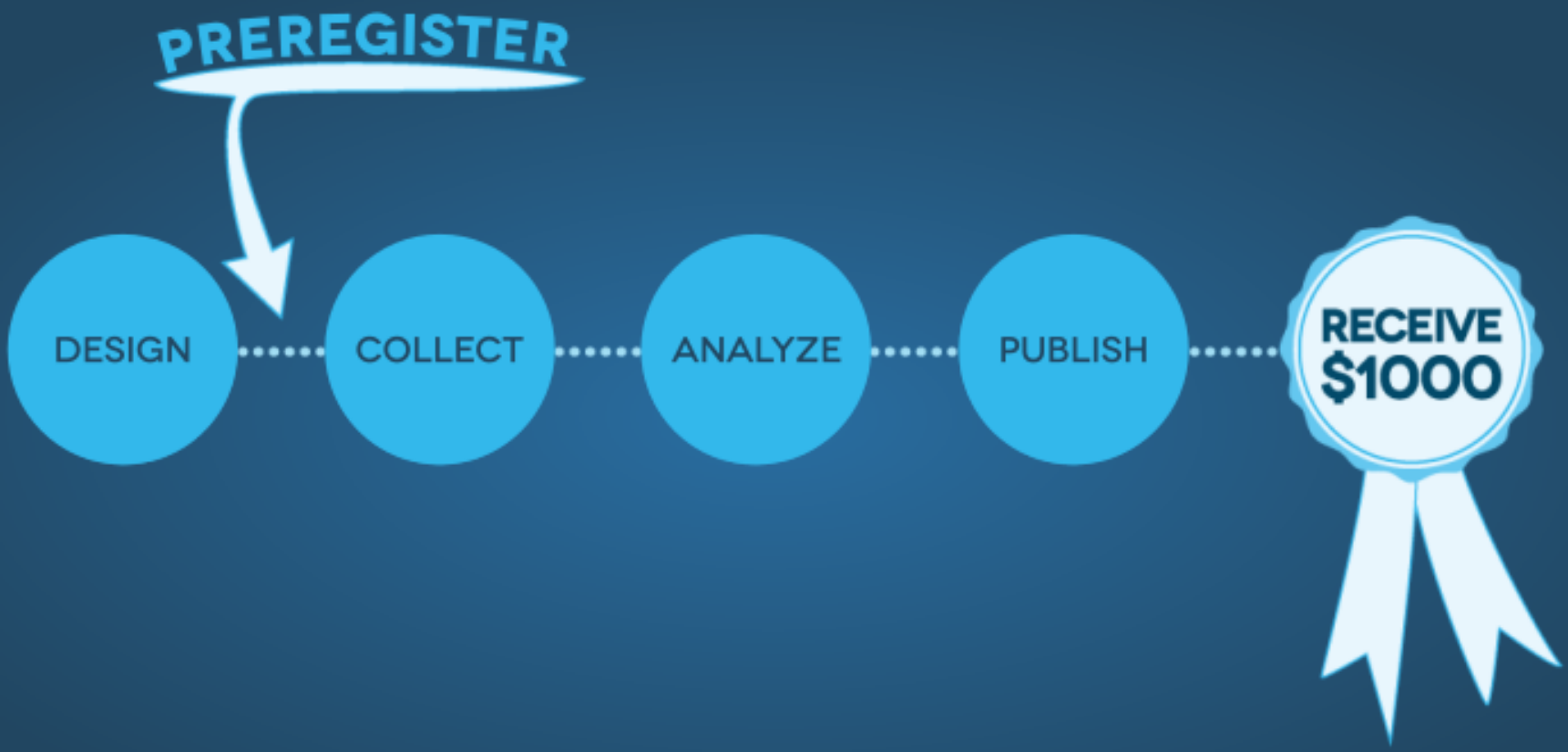
DAVID NEUMARK*

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?

- 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

CENTER FOR OPEN SCIENCE



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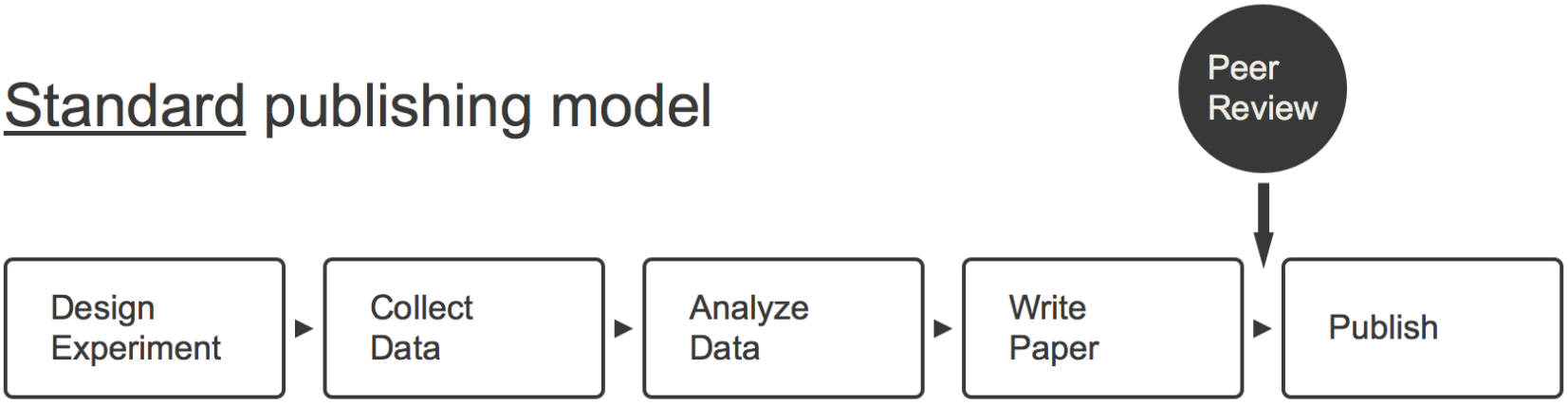
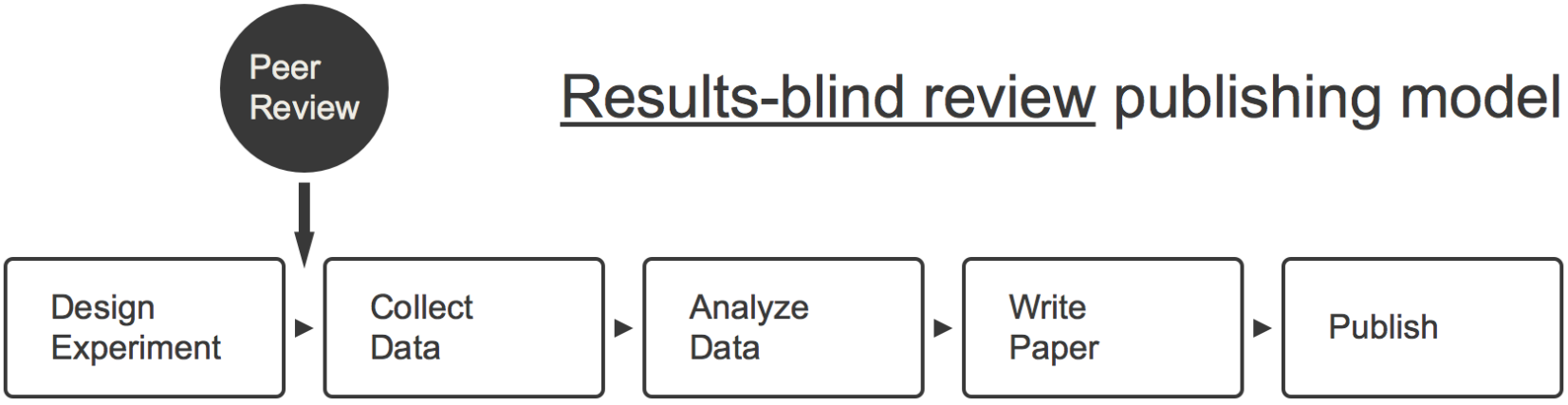
1. Design a project
2. Submit
3. Reviewed based on importance of question and quality of design
4. Get in-principle acceptance
5. Follow through, and nulls get published

14 Journals, 4 more with Special Issues ▸ Link

Standard publishing model



Results-blind review publishing model



Conclusion

- Register your work to reduce publication bias.
- Include a pre-analysis plan to reduce researcher degrees of freedom.
- Register in most appropriate site for your work.
  - AEA
  - EGAP
  - RIDIE
  - OSF will hold anything, and link to your entire workflow.