What is ACCORDS?

Adult and Child Center for Outcomes Research and Delivery Science

ACCORDS is a 'one-stop shop' for pragmatic research:

- A multi-disciplinary, collaborative research environment to catalyze innovative and impactful research
- Strong methodological cores and programs, led by national experts
- Consultations & team-building for grant proposals
- Mentorship, training & support for junior faculty
- Extensive educational offerings, both locally and nationally

ACCORDS Upcoming Events – mark your calendars!

October	• October 22 – ACCORDS/CCTSI Community Engagement Forum
November	• November 4 & 6 – Introduction to Qualitative Research Workshop
December	• December 8 – ACCORDS Highlights
January	• January 12 – ACCORDS Grand Rounds, Bethany Rose-Daubman, MD • January 15 – D&I Science Graduate Certificate application launch • January 28 – ACCORDS/CCTSI Community Engagement Forum
May 20-21, 2026	Colorado Pragmatic Research in Health Conference *Pragmatic Outcomes Research: Methods, Tools, and Technology for Rapidly Changing Contexts*

Full list of events and dates are available on ACCORDS Education website

Laura Scherer, PhD
Associate Professor, Cardiology,
University of Colorado School of Medicine

Open Science: Why and How

University of Colorado **Anschutz Medical Campus**

Open Science and Data Sharing: Why and How

Laura D. Scherer, PhD
Associate Professor
ACCORDS
Division of Cardiology

Mark your calendars: CU School of Medicine's Dean's Distinguished Seminar Series *January 13, 2026*

Brian Nosek

Co-founder and Executive Director

COS CENTER FOR OPEN SCIENCE
SCIENCE WORKS BEST IN THE OPEN

University of Colorado
Anschutz Medical Campus

Talk Roadmap

- Recent Executive Order on “Gold Standard Science”
- “Why”: Personal perspective on the replication crisis in psychology
- “How”: Proposed remedies and how to do them
- Closing remarks

“For the purposes of this order, Gold Standard Science means science conducted in a manner that is:

(i) reproducible;
(ii) transparent;
(iii) communicative of error and uncertainty;
(iv) collaborative and interdisciplinary;
(v) skeptical of its findings and assumptions;
(vi) structured for falsifiability of hypotheses;
(vii) subject to unbiased peer review;
(viii) accepting of negative results as positive outcomes; and
(ix) without conflicts of interest.”

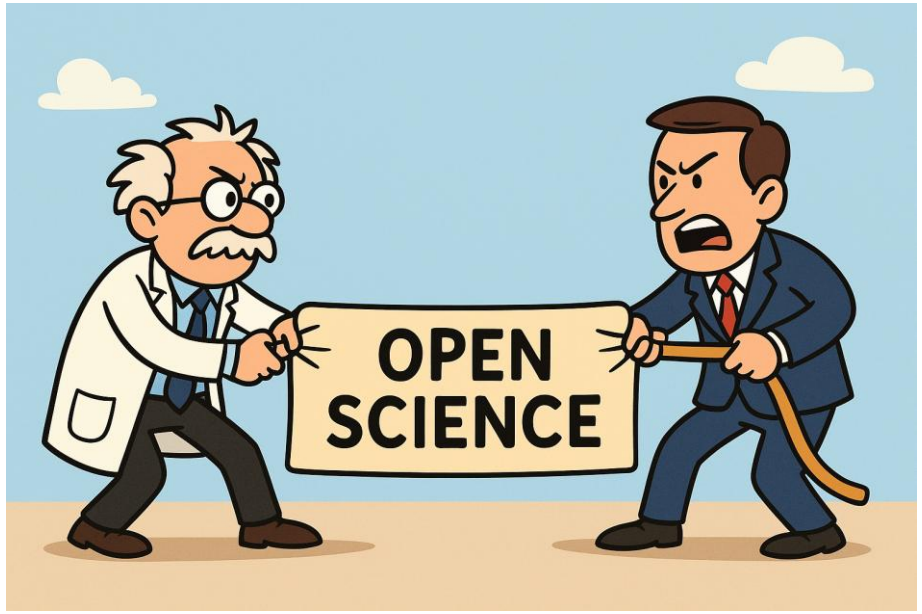
Concerns:

1. The order empowers political appointees to evaluate research.
2. If “Gold Standard” means demanding perfection, this sets the stage for undermining results that are politically inconvenient.
   - ***Example:*** *Tobacco industry using uncertainty to undermine evidence that smoking causes cancer*

Michaels & Wagner, *Science,* 2025; Center for Open Science, 2025; Goldman & Barbati-Dajches, *BMJ,* 2025

Critical tension

The open science movement aims to make science more reliable, reproducible, robust, and self-correcting.



Politicians and industry may use open science ideals as an impossible "gold standard" to undermine scientific discoveries that threaten their interests.

Aschwanden, 2017. There's no such thing as "sound science". *Five Thirty Eight.*

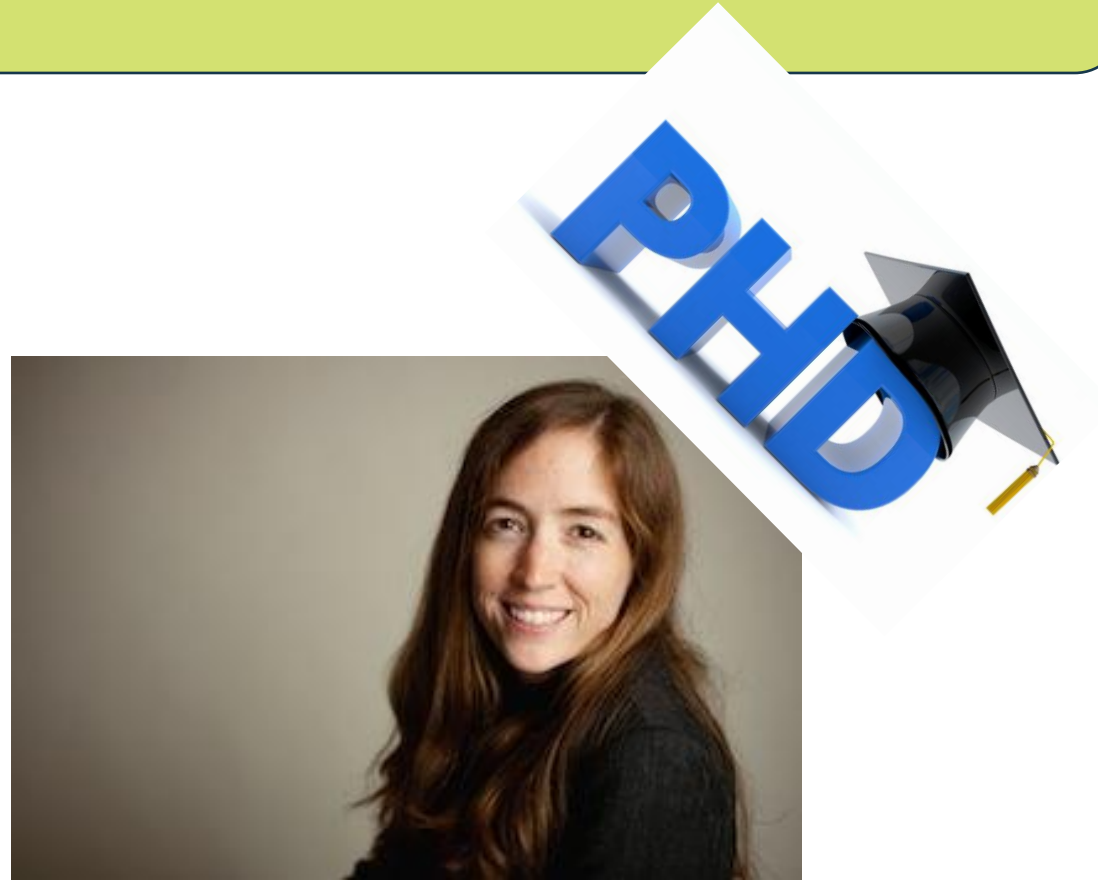
Let's go back in time a bit…to the start of the open science movement

The roots of the modern open science movement can be directly traced back to a series of seismic events in psychology in 2011…

It was the year 2011…

It was the year 2011…

CENTER FOR BIOETHICS AND SOCIAL SCIENCES IN MEDICINE
UNIVERSITY OF MICHIGAN
cbssm.med.umich.edu



Three seismic events in psychological science

nature

Explore content ⌄ About the journal ⌄ Publish with us ⌄ Subscribe

nature › news › article

News | Published: 01 November 2011

Report finds massive fraud at Dutch universities

Ewen Callaway

Nature **479**, 15 (2011) | Cite this article

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The New York Times Magazine

The Mind of a Con Man

Share full article 442

Diederik Stapel, a Dutch social psychologist, perpetrated an audacious academic fraud by making up studies that told the world what it wanted to hear about human nature. Koos Breukel for The New York Times

By Yudhijit Bhattacharjee

April 26, 2013

Stapel did not deny that his deceit was driven by ambition. But it was more complicated than that, he told me. He insisted that he loved social psychology but had been frustrated by the messiness of experimental data, which rarely led to clear conclusions. His lifelong obsession with elegance and order, he said, led him to concoct sexy results that journals found attractive. “It was a quest for aesthetics, for beauty — instead of the truth,” he said. He described his behavior as an addiction that drove him to carry out acts of increasingly daring fraud, like a junkie seeking a bigger and better high.

Meanwhile…

Daryl Bem being interviewed on the Colbert Report in 2011, claiming evidence for ESP

Feeling the future: Experimental evidence for anomalous retroactive influences on cognition and affect. *Journal of Personality and Social Psychology, Vol 100(3) Mar 2011*

SCIENCE

Daryl Bem Proved ESP Is Real

Which means science is broken.

SLATE

BY DANIEL ENGBER

JUNE 07, 2017 • 2:57 PM

"I would start one [experiment], and if it just wasn't going anywhere, I would abandon it and restart it with changes. I didn't keep very close track of which ones I had discarded and which ones I hadn't."

SCIENCE

Daryl Bem Proved ESP Is Real

Which means science is broken.

SLATE

BY DANIEL ENGBER

JUNE 07, 2017 • 2:57 PM

"I was shocked," Wagermakers said. "The paper made it clear that just by doing things the regular way, you could find just about anything."

Direct replications could not be published in the same journal

Editor of Journal of Personality and Social Psychology (where ESP paper was published):

"This journal does not publish replication studies, whether successful or unsuccessful."

https://www.newscientist.com/article/dn20447-journal-rejects-studies-contradicting-precognition/?utm_source=substack&utm_medium=email

False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant

Joseph P. Simmons[1], Leif D. Nelson[2], and Uri Simonsohn[1]
[1]The Wharton School, University of Pennsylvania, and [2]Haas School of Business, University of California, Be

Finally, the "straw"

Simmons, Nelson & Simonsohn 2011

- **Study 1:** Listening to a children's tune can make people feel younger, *p*=.03
- **Study 2:** Listening to a tune about older age (*When I'm 64* by the Beatles) can make people ***actually older***, *p*=.04

“Researcher degrees of freedom”

- We can fool ourselves into thinking we’ve found a notable effect ($p<.05$) by making post hoc analytic decisions, such as:
  - Choosing among outcome measures
  - Adding covariates, exploring interaction effects
  - Reporting subset of experimental conditions
  - Removing outliers, recoding variables
- **And then HARKing**: *Hypothesizing After the Results are Known* (Kerr, 1998)

Inflating the false positive error rate

Table 1. Likelihood of Obtaining a False-Positive Result

Researcher degrees of freedom	Significance level		
	$p < .1$	$p < .05$	$p < .01$
Situation A: two dependent variables ($r = .50$)	17.8%	9.5%	2.2%
Situation B: addition of 10 more observations per cell	14.5%	7.7%	1.6%
Situation C: controlling for gender or interaction of gender with treatment	21.6%	11.7%	2.7%
Situation D: dropping (or not dropping) one of three conditions	23.2%	12.6%	2.8%
Combine Situations A and B	26.0%	14.4%	3.3%
Combine Situations A, B, and C	50.9%	30.9%	8.4%
Combine Situations A, B, C, and D	81.5%	60.7%	21.5%

Simmons, Nelson, & Simonsohn (2011) doi.org/10.1177/095679761141

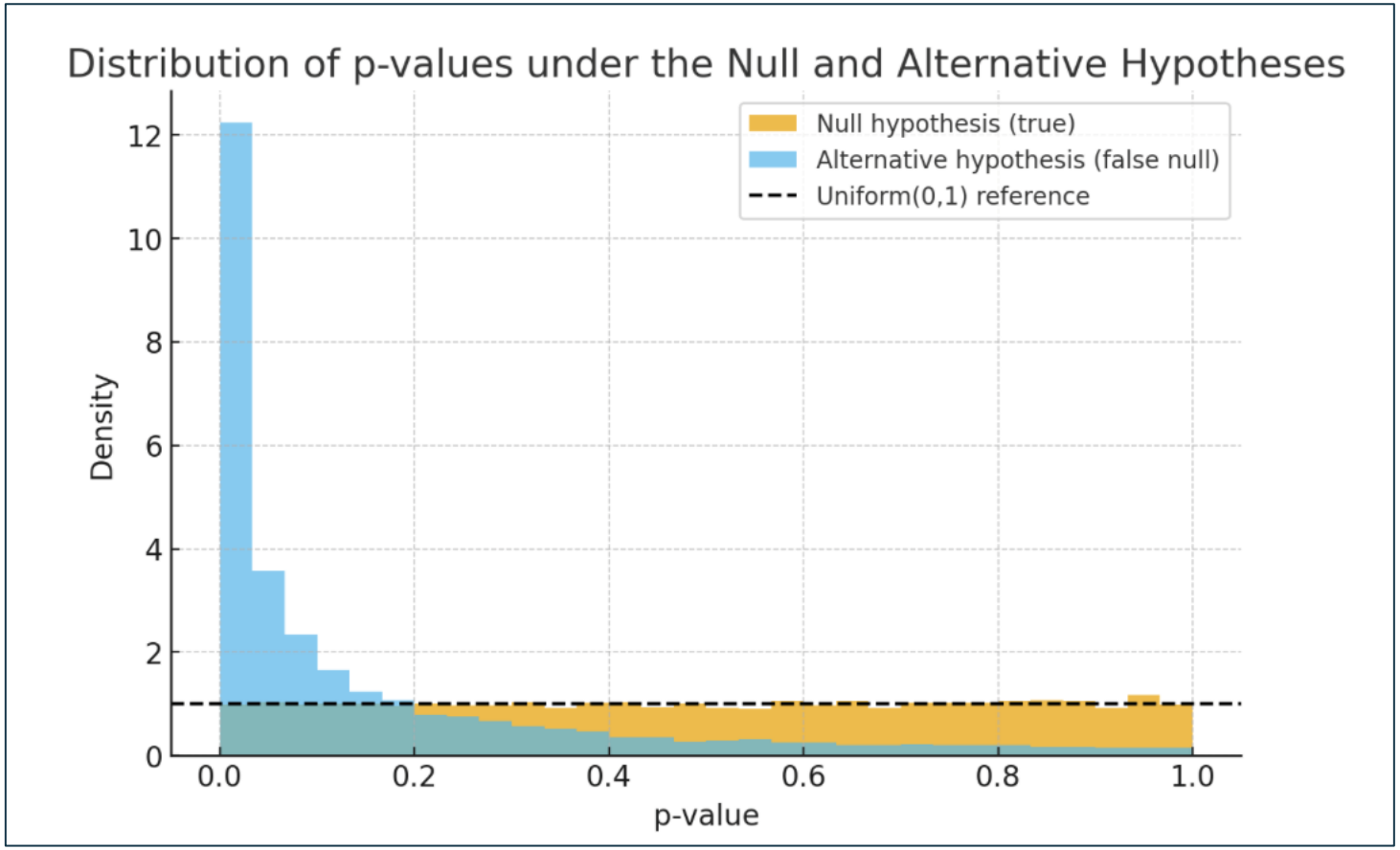
Aftermath

- Numerous large-scale replication projects generate more failed replications, more controversy, and lots of navel-gazing
  - The Reproducibility Project: Psychology
  - Many Labs 1-6
- Many researchers push back. Things get ugly
  - Generational divide
- The field of “metascience” is born


The New York Times

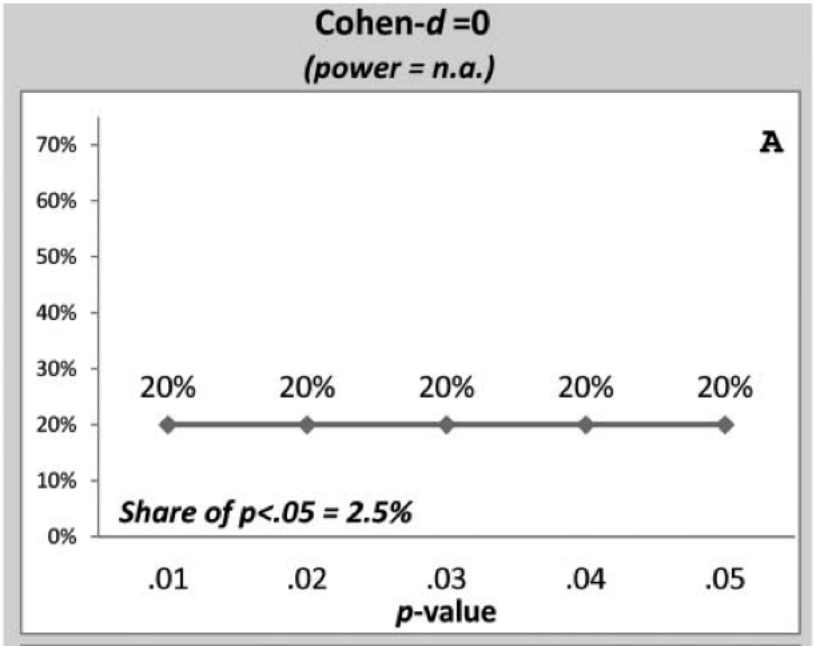
Many Psychology Findings Not as Strong as Claimed, Study Says

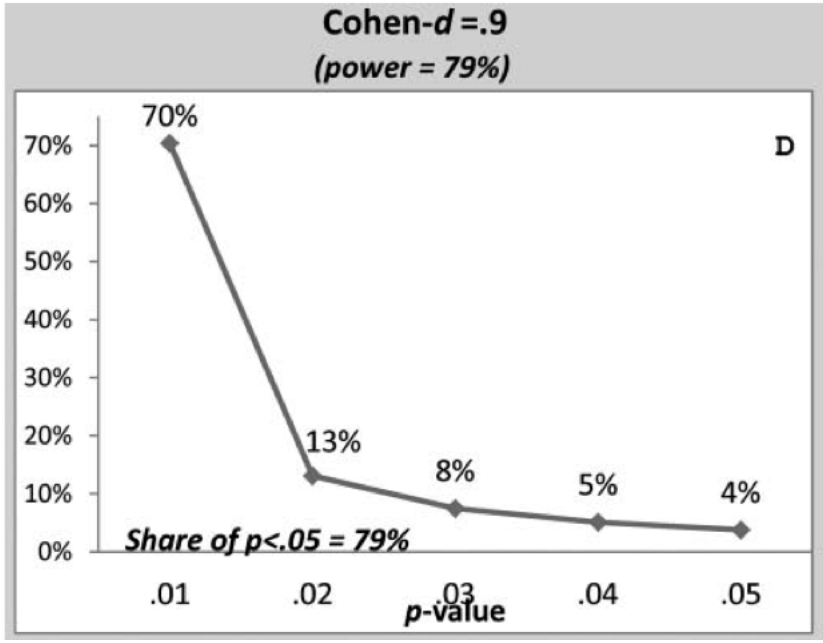
Metascience example: p-hacking detection through a proposed “p curve” analysis



Simonsohn, Nelson & Simmons, 2014

Metascience example: p-hacking detection through a proposed “p curve” analysis





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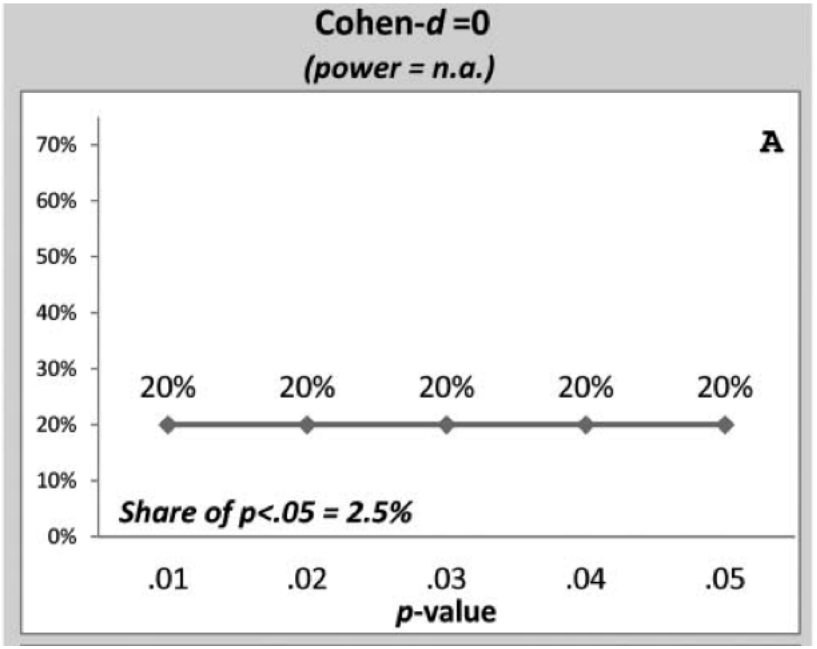
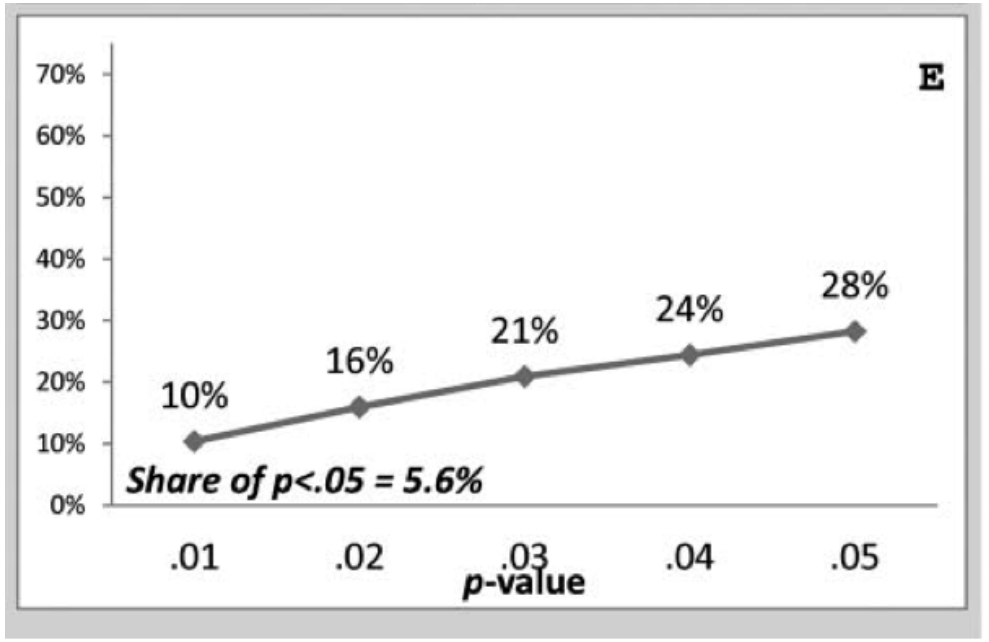
Simonsohn, Nelson & Simmons, 2014

Metascience example: p-hacking detection through a proposed “p curve” analysis



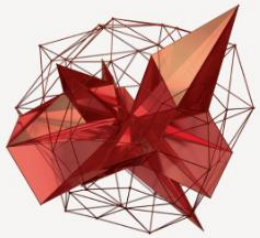


Modelling p-hacking

Simonsohn, Nelson & Simmons, 2014

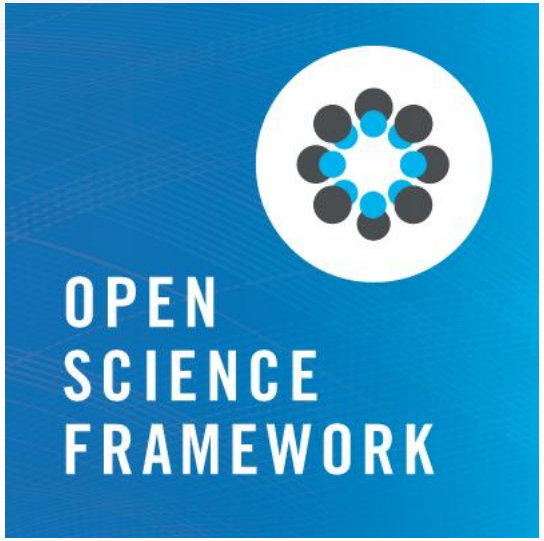
Aftermath

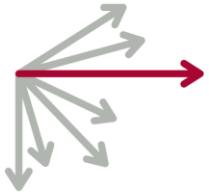
- Numerous solutions posed:
  - Open sharing of data, protocols, materials
  - Pre-registration
  - Registered reports
- New infrastructure created: Open Science Framework
- SIPS is born



METASCIENCE
The Emerging Field of Research on the Scientific Process.

SIPS
SOCIETY FOR THE IMPROVEMENT OF PSYCHOLOGICAL SCIENCE





ASPREDICTED

Common reactions

“Wow, psychology was so messed up! Glad my science doesn’t have these problems.”

or…

“Oh crap, I am guilty of this.”

Examples of the slippery slope

John finds the overall effect of his intervention is "trending toward significance", p=.07 (so frustrating!). Looking at a bunch of subgroups, he finds the intervention had a significant effect (p=.04) among men, which in retrospect totally makes sense. He writes an article reporting the overall p=.07 while strongly emphasizing the significant effect among men.

Examples of the slippery slope

Laura has a really expensive data set. She publishes the primary outcome and then spends some time doing secondary analyses to make use of these valuable data. She sees a really interesting story emerging, so she writes it up. In the article she states a hypothesis and then shows support for it without mentioning the hypothesis was developed after the result was known.

Richard P. Feynman, *Cargo Cult Science*, 1974:

> *The first principle is that you must not fool yourself, and you are the easiest person to fool.*
>
> *After you've not fooled yourself, it's easy not to fool other scientists. You just have to be honest in a conventional way after that.*

A shout out to biostatisticians

- Here in medical science, we have biostatisticians to save us from ourselves (thank you biostats!)
- However, they are dealing with a few issues:
  - “Oh wait, what about this” analysis requests
  - Pressure to deliver publishable results

The Atlantic

SCIENCE

Is biomedical research self-correcting? Modelling insights on the persistence of spurious science

David Robert Grimes [1,2,✉]

...ri

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About 40% of economics experiments fail replication survey

Compared with psychology, the replication rate "is rather good," researchers say

3 MAR 2016 · BY JOHN BOHANNON

University of Colorado
Anschutz Medical Campus

Signs of an at-risk science

- **Journal bias favoring statistically significant, hypothesis confirming studies**
  - Result: Hypothesis-disconfirming data is hidden
- **Pressure to publish**
  - Result: Incentive to use researcher degrees of freedom to find significance, which inflates the false positive error rate
  - Worse result: Outright fraud
- **Direct replications are not normative or feasible**
  - Result: False positive results are rarely corrected

Creating More Robust Science with Open Science Practices

University of Colorado
Anschutz Medical Campus

Open Science Practices

Threats to science:

- Fraud
- P-hacking
- HARKing
- Publication bias
- Lack of direct replication

Solutions:

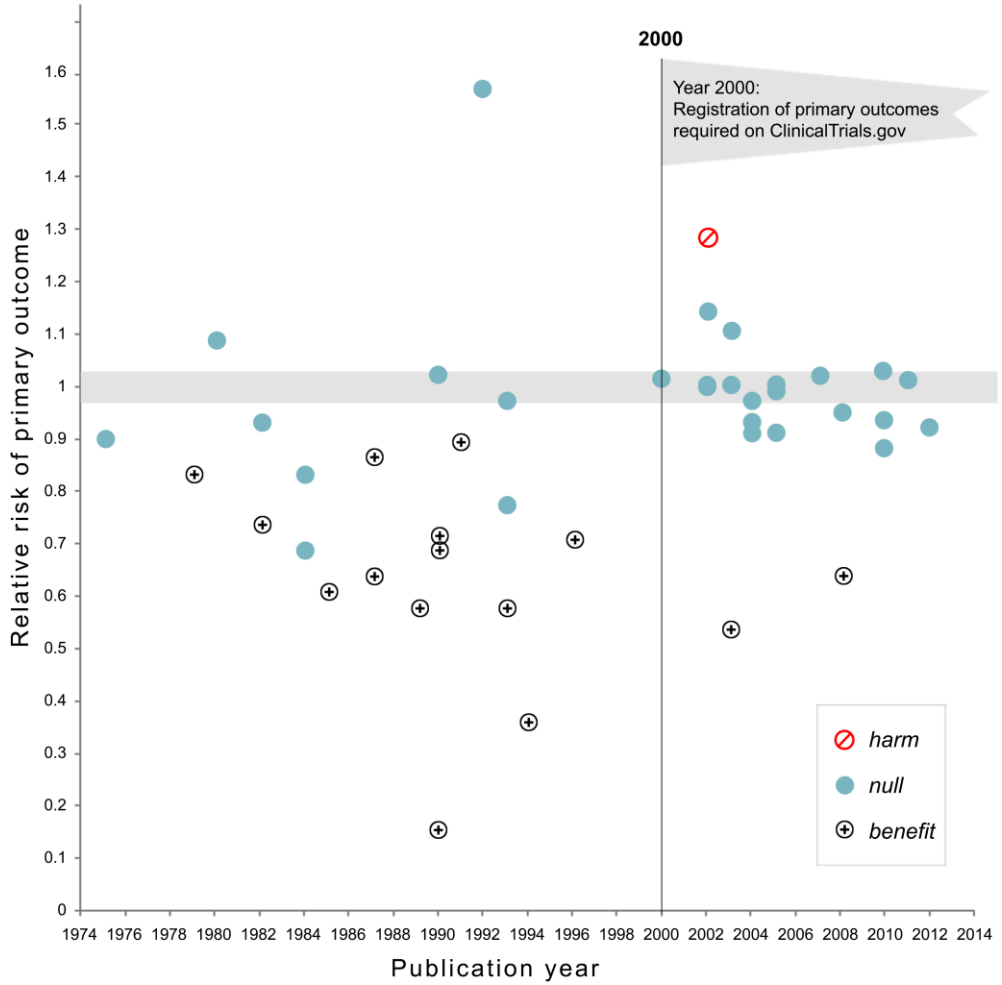
- ClinicalTrials.gov

The Role of ClinicalTrials.gov

- Created to address 2 major problems:
  - Patients couldn't find trials to join
  - Publication bias

The Role of ClinicalTrials.gov

- Kaplan & Irvin, 2015: Proportion of trials reporting null effects increased from 43% to 92% after registration became required



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The Role of ClinicalTrials.gov

- However, ClinicalTrials.gov does not…
  - Prevent trials from being post-registered or altered (!)
  - Require researchers to pre-specify a complete analytic plan
  - Prevent some forms of p-hacking, data mining
- Other issues:
  - Not all studies are registered on CT.gov
  - Platform is built for drug trials and is otherwise extremely difficult to use

Open Science Practices

Threats to science:

- Fraud
- P-hacking
- HARKing
- Publication bias
- Lack of direct replication

Solutions:

- ClinicalTrials.gov
- Sharing data

2 key benefits:

- Allows identification of analytic errors
- Allows detection of (some kinds of) fraud

Example

Schrag, who had not publicly revealed his role as a whistleblower until this article, avoids the word "fraud" in his critiques of Lesné's work and the Cassava-related studies and does not claim to have proved misconduct. That would require access to original, complete, unpublished images and in some cases raw numerical data. "I focus on what we can see in the published images, and describe them as red flags, not final conclusions," he says. "The data should speak for itself."

Another example

THE NEW YORKER

THEY STUDIED DISHONESTY. WAS THEIR WORK A LIE?

Dan Ariely and Francesca Gino became famous for their research into why we bend the truth. Now FREAKONOMICS RADIO *accused of fabricating data*

By Gideon Lewis-Kraus

September 30, 2023

Team who uncovered the fraud

DATA COLADA

Thinking about evidence, and vice versa

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How to share your data

- **Open Science Framework**
- **Figshare**
- **Harvard Dataverse Network**
- **Dryad Digital Repository**

- https://journals.plos.org/plosone/s/recommended-repositories

Open Science Practices

Threats to science:

- Fraud
- P-hacking
- HARKing
- Publication bias
- Lack of direct replication

Solutions:

- ClinicalTrials.gov
- Sharing data
- Specify your analytic plan using pre-registration

Pre-registration

Pre-registration is a public, time-stamped document that specifies in advance the hypotheses and analytic plan, with a goal of preventing p-hacking

- Planned sample size
- All study conditions
- Primary / secondary dependent variables
- Data processing and cleaning procedures, e.g. removing outliers
- Hypotheses & planned analyses to test them, including details such as inclusion of covariates
- Allows documentation of changes to plans, and rationale

How to do a pre-registration

- User-friendly websites:
  - **AsPredicted.org**
  - **Open Science Framework:** https://osf.io/prereg/
- Create time- and date-stamped shareable document
- AsPredicted is simpler, shorter, less comprehensive than OSF

Open Science Practices

Threats to science:

- Fraud
- P-hacking
- HARKing
- Publication bias
- Lack of direct replication

Solutions:

- ClinicalTrials.gov
- Sharing data
- Specify your analytic plan using pre-registration
- Registered Reports

Traditional academic publishing model:

Registered Report model

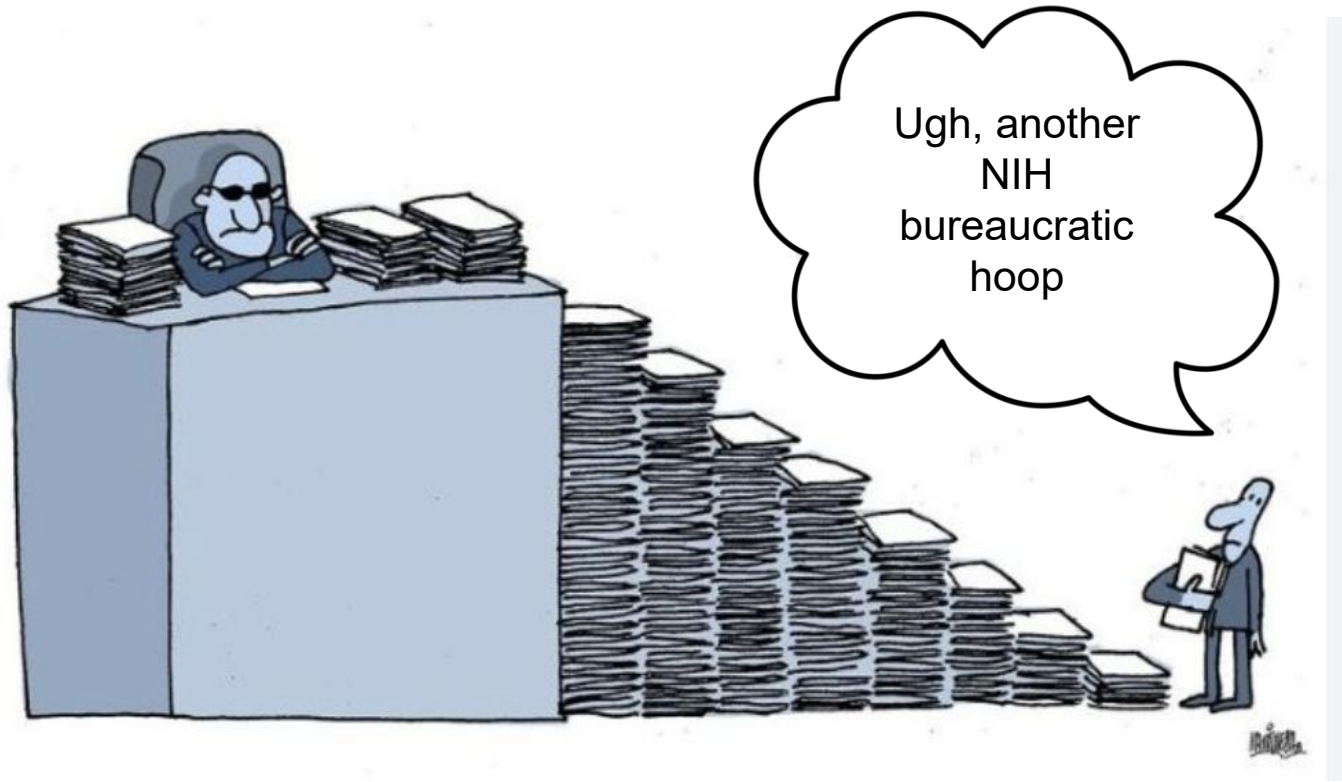
Why Registered Reports?

- Eliminates publication bias (i.e., selection of statistically significant effects that fit with preexisting theory)
  - 96% positive findings in random sample of psychology articles vs. 44% positive findings in 70 Registered Reports (Scheel et al., 2021)
- Focuses reviewer attention on the quality of the ***question*** and the ***method***
- Avoids wasted effort: Reviewer feedback can *improve* a study, not just critique it

Closing Remarks

2023 NIH Data Management and Sharing Policy

The NIH has issued a Data Management and Sharing (DMS) policy, effectiv 2023, to promote the sharing of scientific data. There are multiple benefits to scientific data, and ultimately this will facilitate the development of treatmer products that improve human health.



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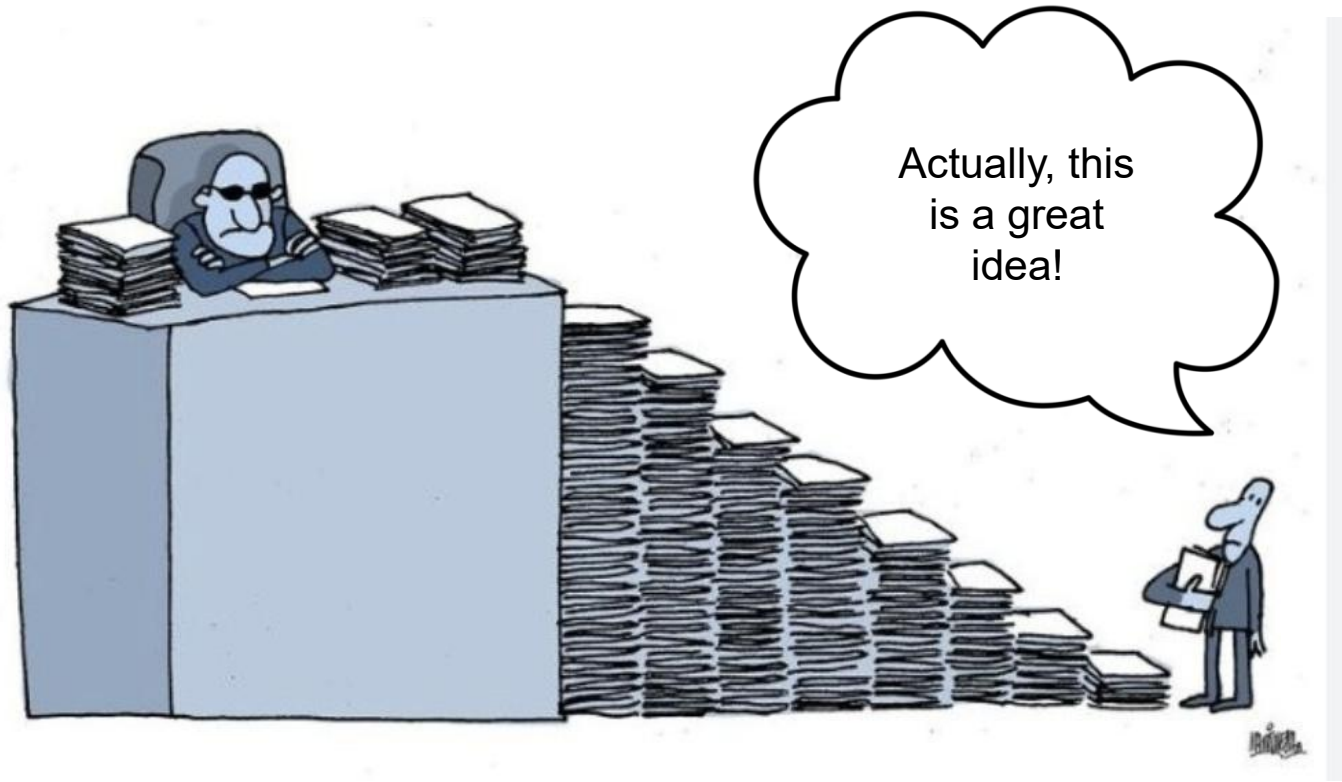
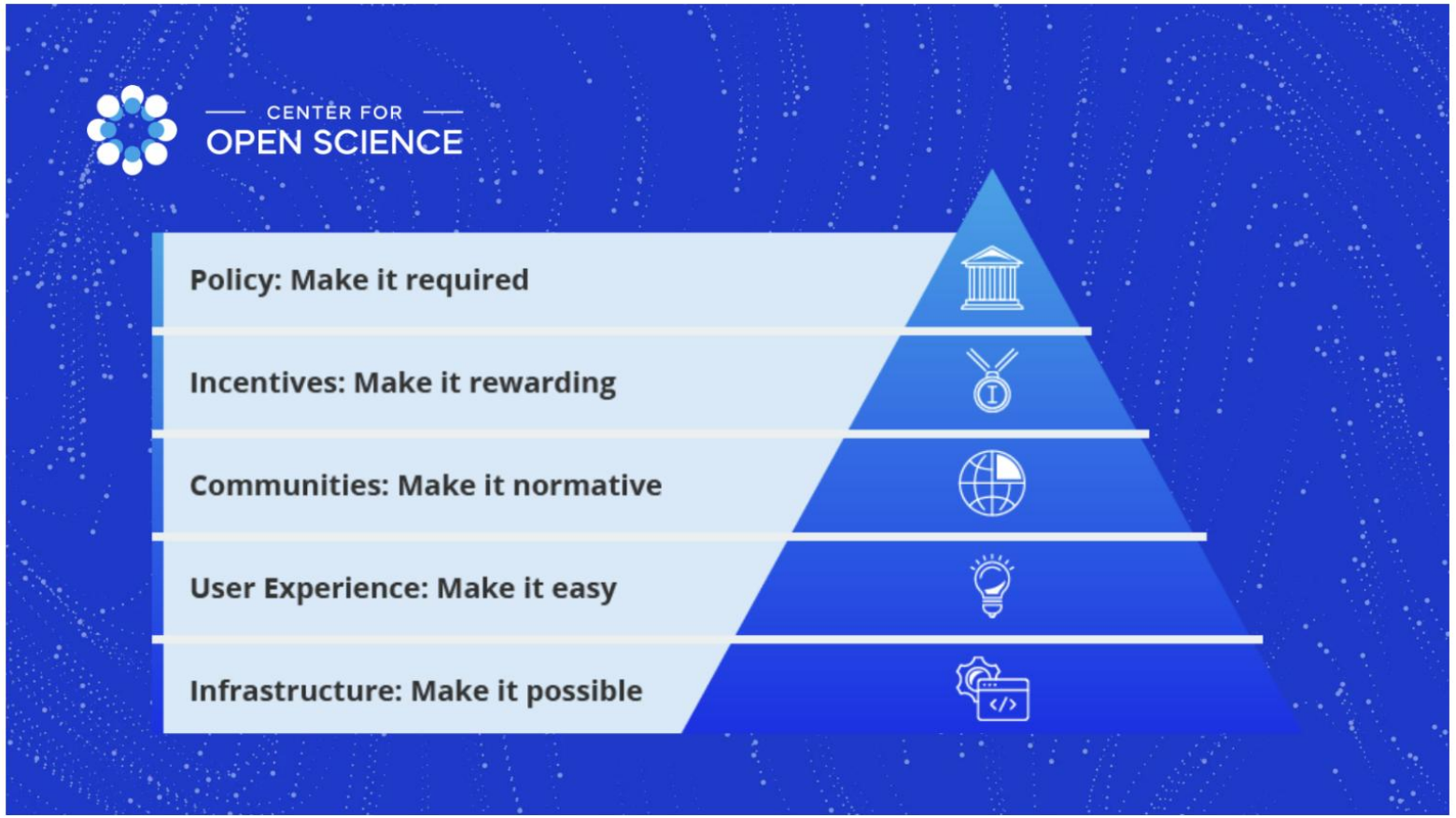
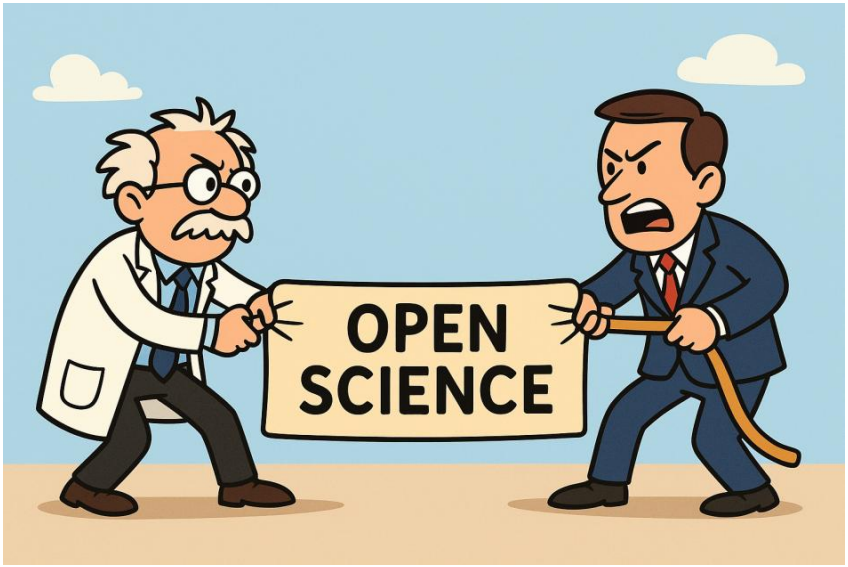


Closing Remarks



Closing Remarks

- This talk touched on fraud, questionable research practices, & problematic incentive structures in science
- Worry: If we talk about these problems it will sow public distrust
- Counterpoint: We need to actively confront problems in science to earn and keep public trust
- If we don’t continue to address problems, we allow politicians to control the narrative and the solutions



THANK YOU

Contact:
Laura Scherer, PhD
Associate Professor
laura.scherer@cuanschutz.edu
@ldscherer.bsky.social

Mark your calendars: CU School of Medicine's Dean's Distinguished Seminar Series *January 13, 2026*

Brian Nosek

Co-founder and Executive Director

COS CENTER FOR OPEN SCIENCE
SCIENCE WORKS BEST IN THE OPEN

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Resources:

Data repository options:

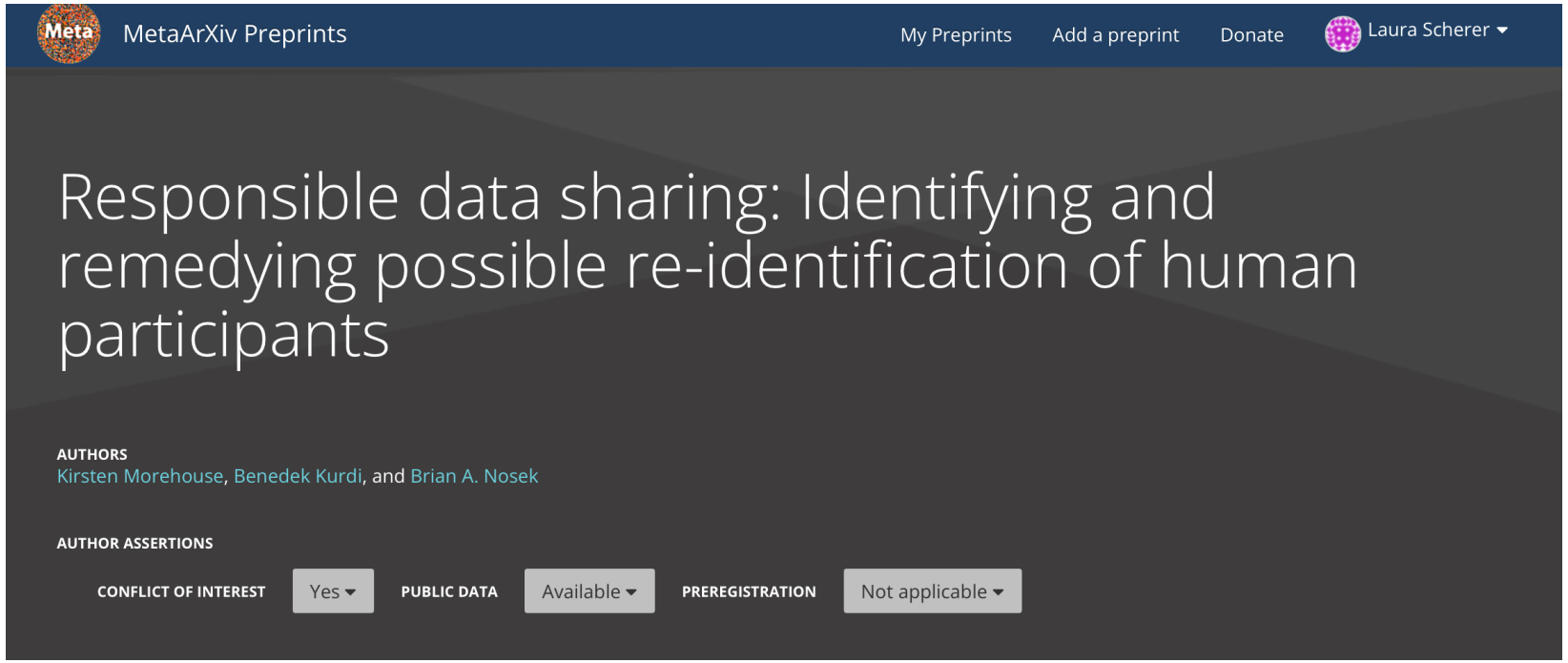
Center for Open Science: https://www.cos.io

Open Science Framework (for sharing data & materials, pre-registration): https://osf.io

User-friendly pre-registration website: https://aspredicted.org

Transparency, Openness and Reproducibility (TOP) Guidelines: https://www.science.org/doi/10.1126/science.aab2374

Bonus slides…



REGISTERED REPORTS

- Adv in Mthds & Practices in Psyc Sci
- AIMS Neuroscience
- Attention, Percept., & Psychophys
- Cognition and Emotion
- Cognitive Research
- Comp. Results in Social Psychology
- Cortex
- Drug and Alcohol Dependence
- eLife
- Euro Journal of Neuroscience
- Experimental Psychology
- Human Movement Science
- Infancy
- Int'l Journal of Psychophysiology
- Journal of Accounting Research
- Journal of Business and Psychology

- Journal of Cogn. Enhancement
- Journal of Euro. Psych. Students
- Journal of Expt'l Political Science
- Journal of Personnel Psychology
- Journal of Media Psychology
- Leadership Quarterly
- Management & Org Review
- Nature Human Behaviour
- Nicotine and Tobacco Research
- NFS Journal
- Nutrition and Food Science Journal
- Perspectives on Psych. Science
- Royal Society Open Science
- Social Psychology
- Stress and Health
- Work, Aging, and Retirement

more at cos.io/rr

Lessons learned from handling Registered Reports

- For authors:
  - Make sure the research question is well justified
  - Present pilot work / preliminary studies
  - Clearly describe all methods
  - Clearly describe all planned analyses
  - REMEMBER: Your introduction and methods cannot be altered once accepted

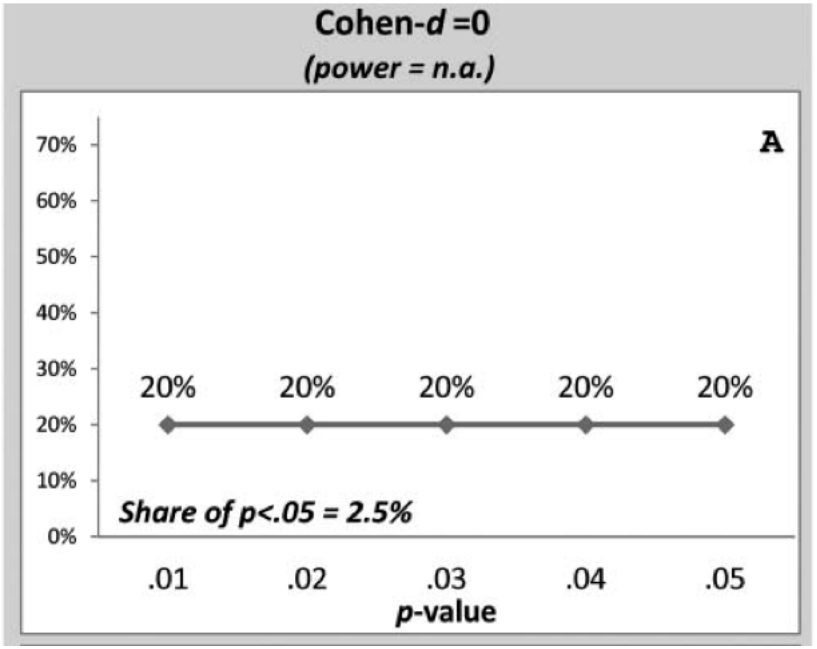
Lessons learned from handling RRs

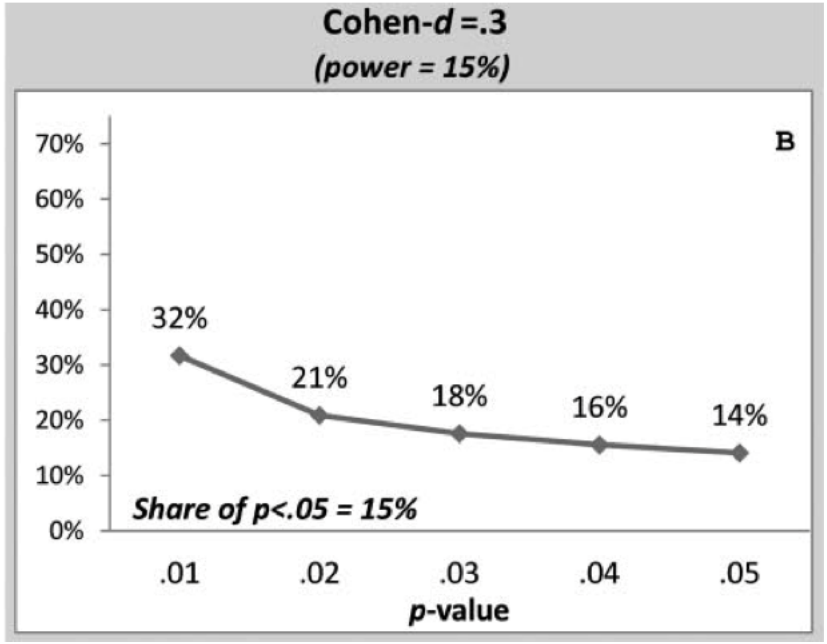
- For reviewers:
  - Ask yourself:
    - Is this an important, well-justified question?
    - Can these methods satisfactorily answer the question?
    - Are these analyses appropriate?
  - If NO: Ask for changes to the methods and analyses
  - REMEMBER: The introduction and methods cannot be altered once accepted

Pre-registration vs. CT.gov

	ClinicalTrials.gov	Preregistration
Publication bias	Allows detection, not prevention	Does not address: No single searchable repository
Selective reporting of outcomes	Allows detection, not prevention	Allows detection, not prevention
HARKing	Allows detection for primary outcomes, not secondary analyses	Allows detection, not prevention
P-hacking	Does not address adequately: No specified analyses	Allows detection, not prevention

p-hacking detection through a proposed “p curve” analysis





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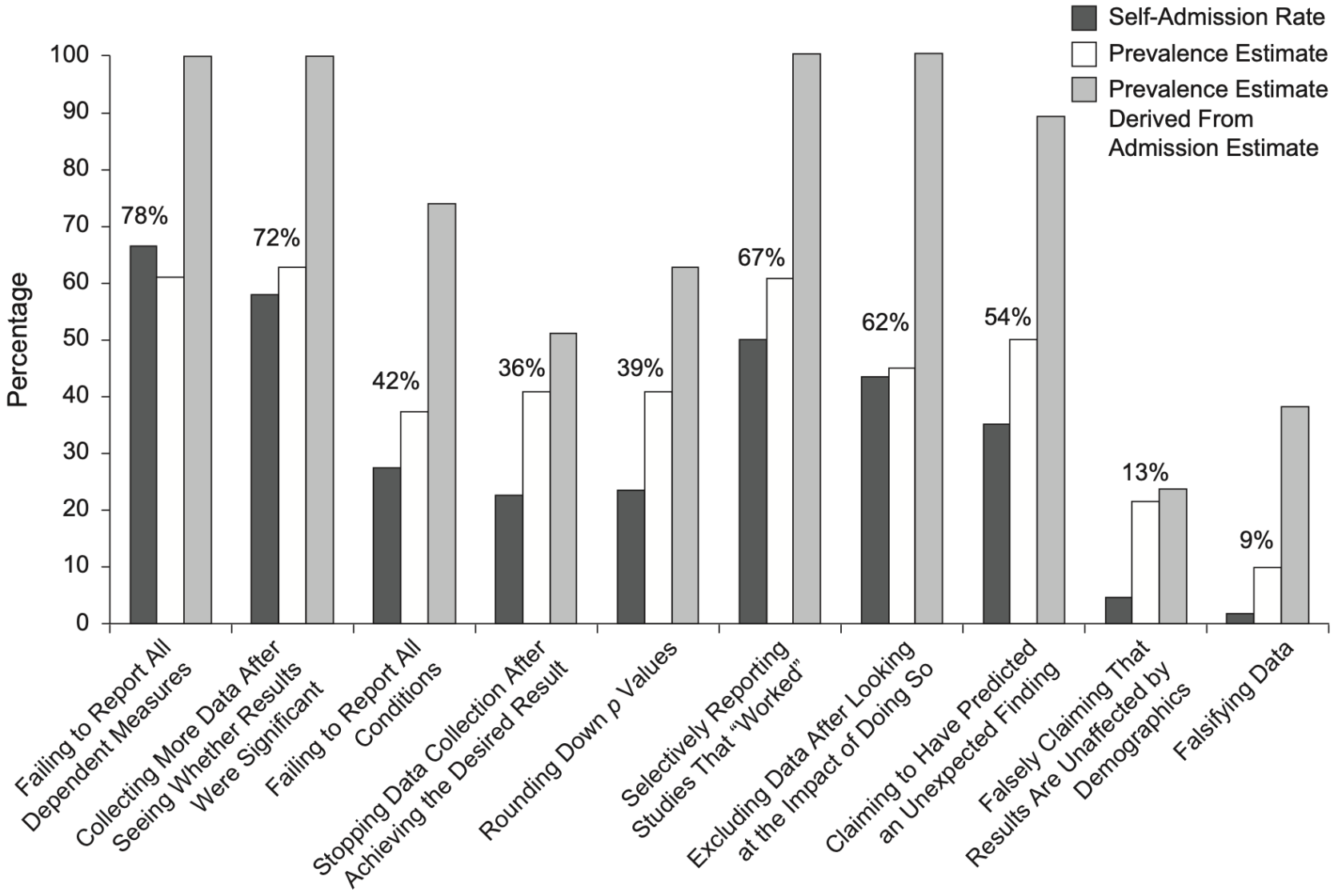
Simonsohn, Nelson & Simmons, 2014

Which of the following statements is true?

- You test an intervention against a control condition and a statistical test yields p=.04. Which of the following is true:
  - The p-value indicates a 4% probability that the intervention was not effective
  - The p-value indicates a 4% probability that the results are due to random chance rather than the intervention
  - The fact that there is a significant different means your intervention works and is clinically significant
  - The p-value indicates that the observed data would occur only 4% of the time if the null hypothesis were true.



John, Loewenstein, Prelec, 2012

Pre-registration FAQ

What if I want to do exploratory analyses to learn from my data?

- You can and *should* do exploratory analyses!
- Pre-registration helps maintain a clearer distinction between confirmatory & exploratory analyses
- Journal reviewers should come to expect clear distinctions between a priori and post hoc reports