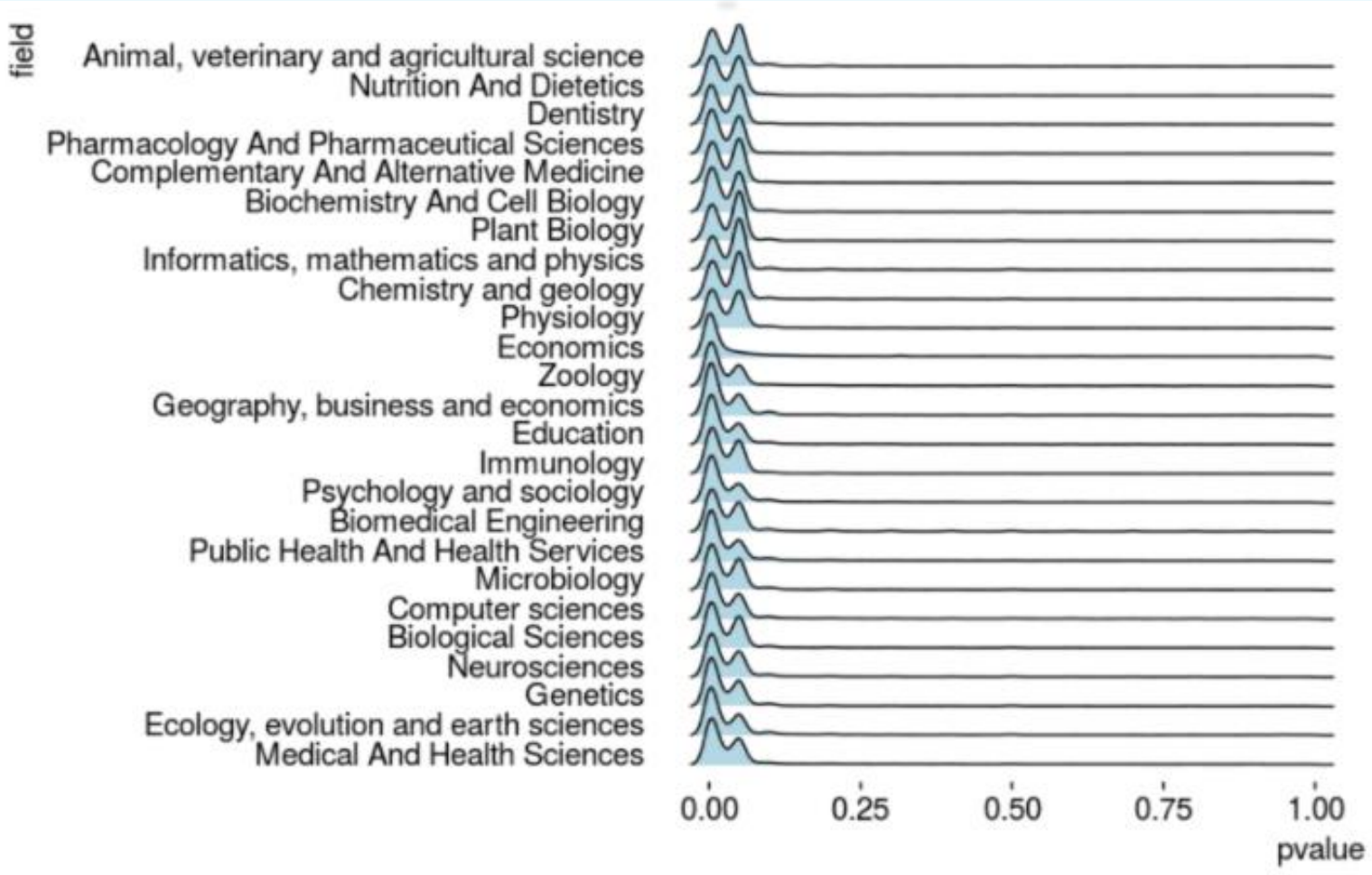
Preregistration and Registered Reports for Systematic Reviews

David Mellor
@EvoMellor
david@cos.io

Find this presentation at: https://osf.io/m28gf

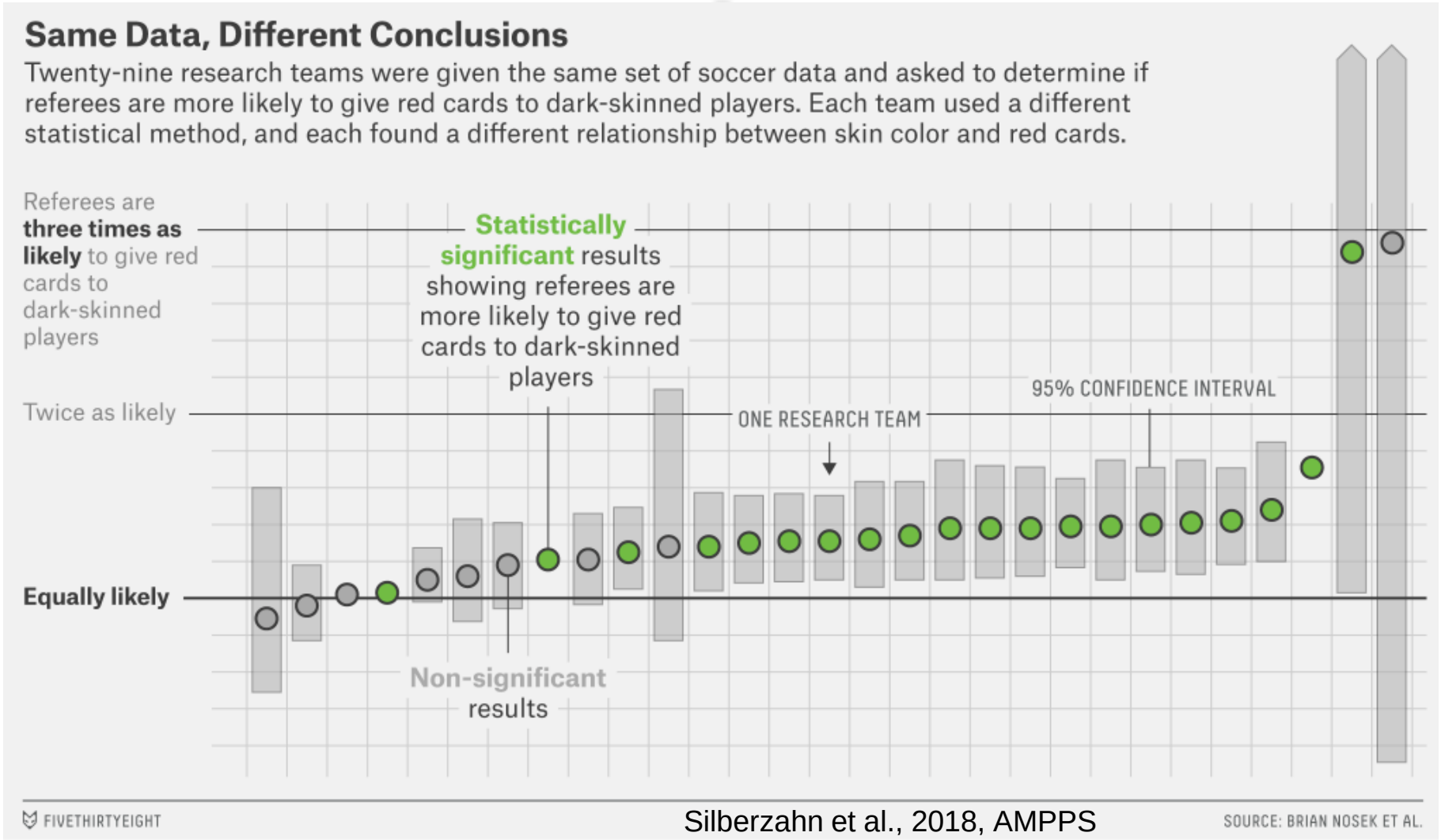
The combination of a strong bias toward statistically significant findings and flexibility in data analysis results in irreproducible research

The combination of a strong bias toward statistically significant findings and flexibility in data analysis results in irreproducible research



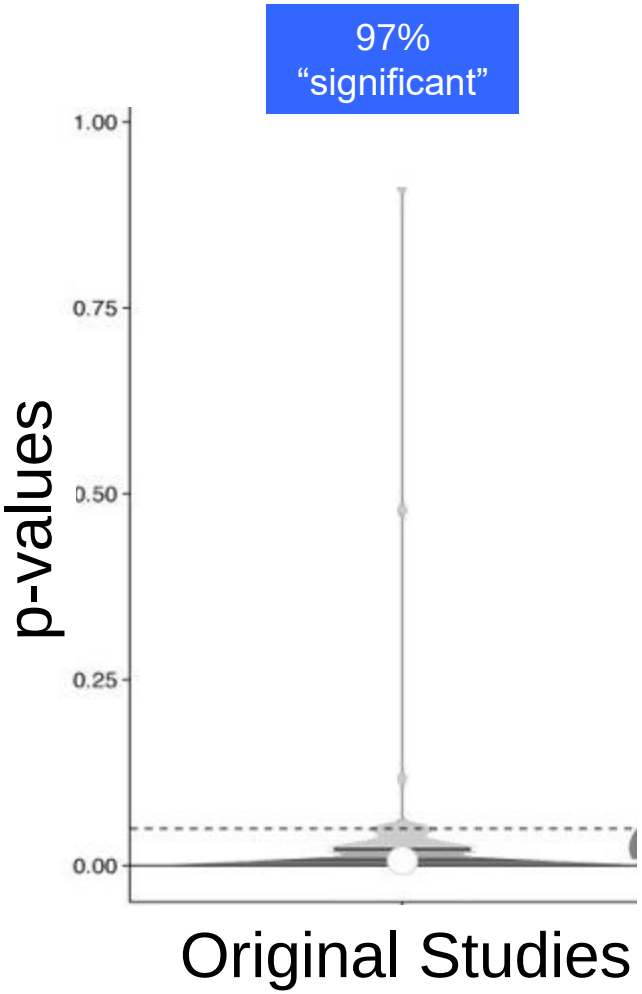
https://simplystatistics.org/2017/07/26/announcing-the-tidypvals-package/

The combination of a strong bias toward statistically significant findings and flexibility in data analysis results in irreproducible research



Silberzahn et al., 2018, AMPPS

The combination of a strong bias toward statistically significant findings and flexibility in data analysis results in irreproducible research

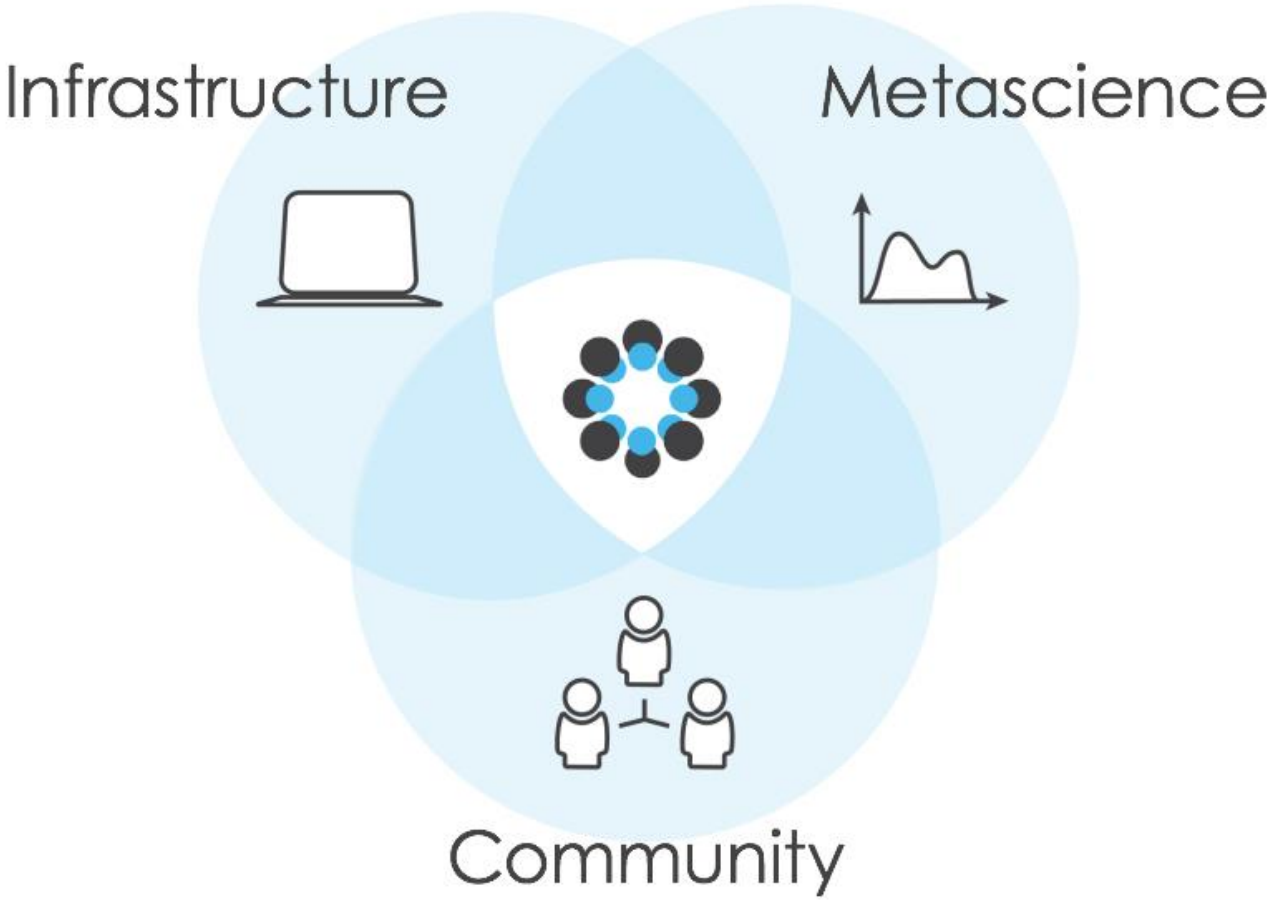


The combination of a strong bias toward statistically significant findings and flexibility in data analysis results in irreproducible research

Many Labs 1	10 of 13 (77%)
Many Labs 2	14 of 28 (50%)
Many Labs 3	3 of 10 (30%)
Reproducibility Project: Psychology	39 of 100 (39%)
Science/Nature: Social Science	13 of 21 (62%)
Experimental Economics	11 of 18 (61%)
Total	90 of 190 (47%)

CENTER FOR OPEN SCIENCE

Our mission is to increase openness, integrity, and reproducibility of research.



Open Science Practices

Make available, to the greatest extent permissible by legal and ethical constraints, data underlying reported results.

Make available research materials or analytical code for others to use and reuse.

Make a clear distinction between planned hypothesis tests and unplanned exploratory research by using preregistration.

Preregistration

Preregistration increases credibility by specifying in advance how data will be analyzed, thus preventing biased reasoning from affecting data analysis.

cos.io/prereg

What is a preregistration?

A research plan that is

- Time-stamped
- Immutable or read-only
- Created before the study
- Submitted to a public registry

Study plan:

- Hypothesis
- Data collection procedures
- Manipulated and measured variables

Analysis plan:

- Statistical model
- Inference criteria

What problems do preregistration fix?

Preregistration makes the distinction between **confirmatory** (hypothesis testing) and **exploratory** (hypothesis generating) research more clear.

Confirmatory versus exploratory analysis

Context of confirmation

Traditional hypothesis testing

Results held to the highest standards of rigor

Goal is to minimize false positives

P-values interpretable

Preregistration

Context of discovery

Pushes knowledge into new areas/ predata-led discovery

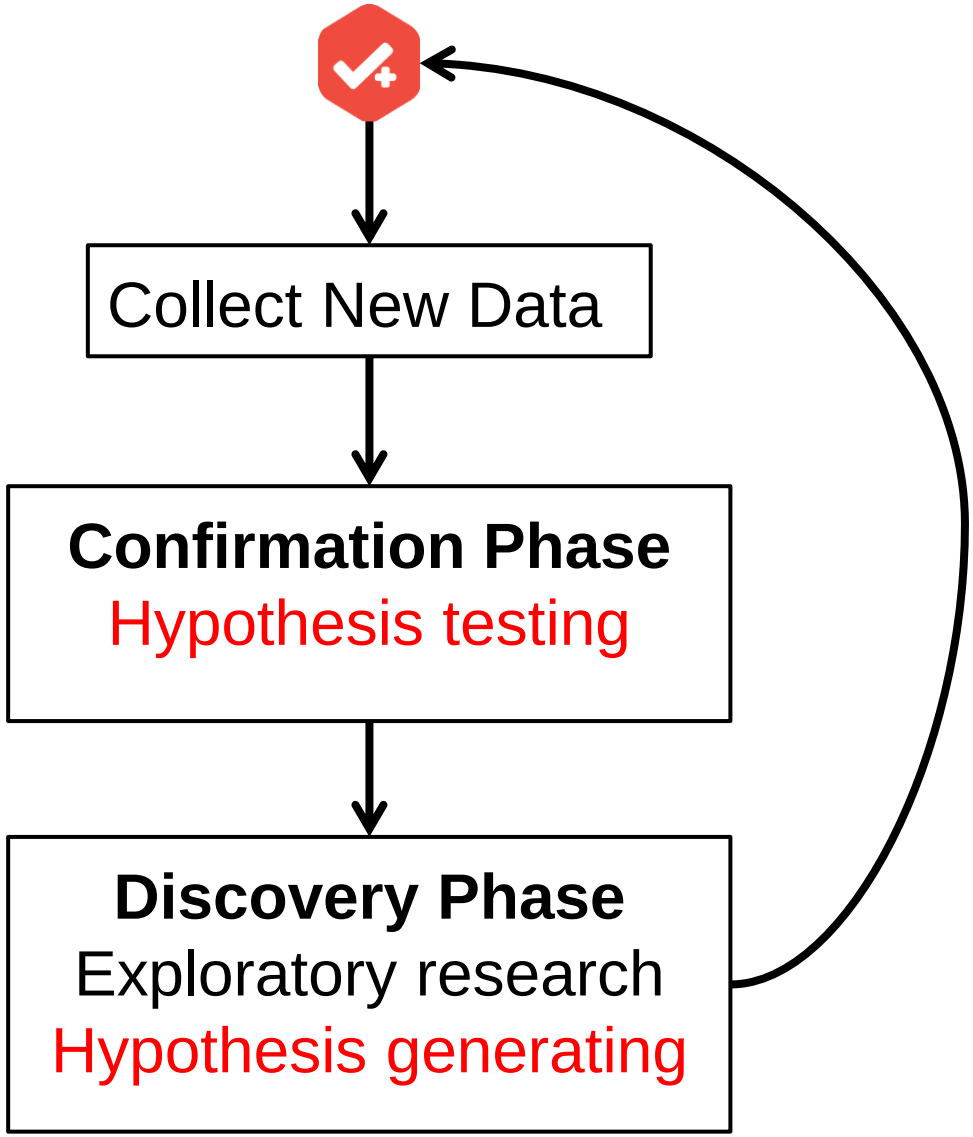
Finds unexpected relationships

Goal is to minimize false negatives

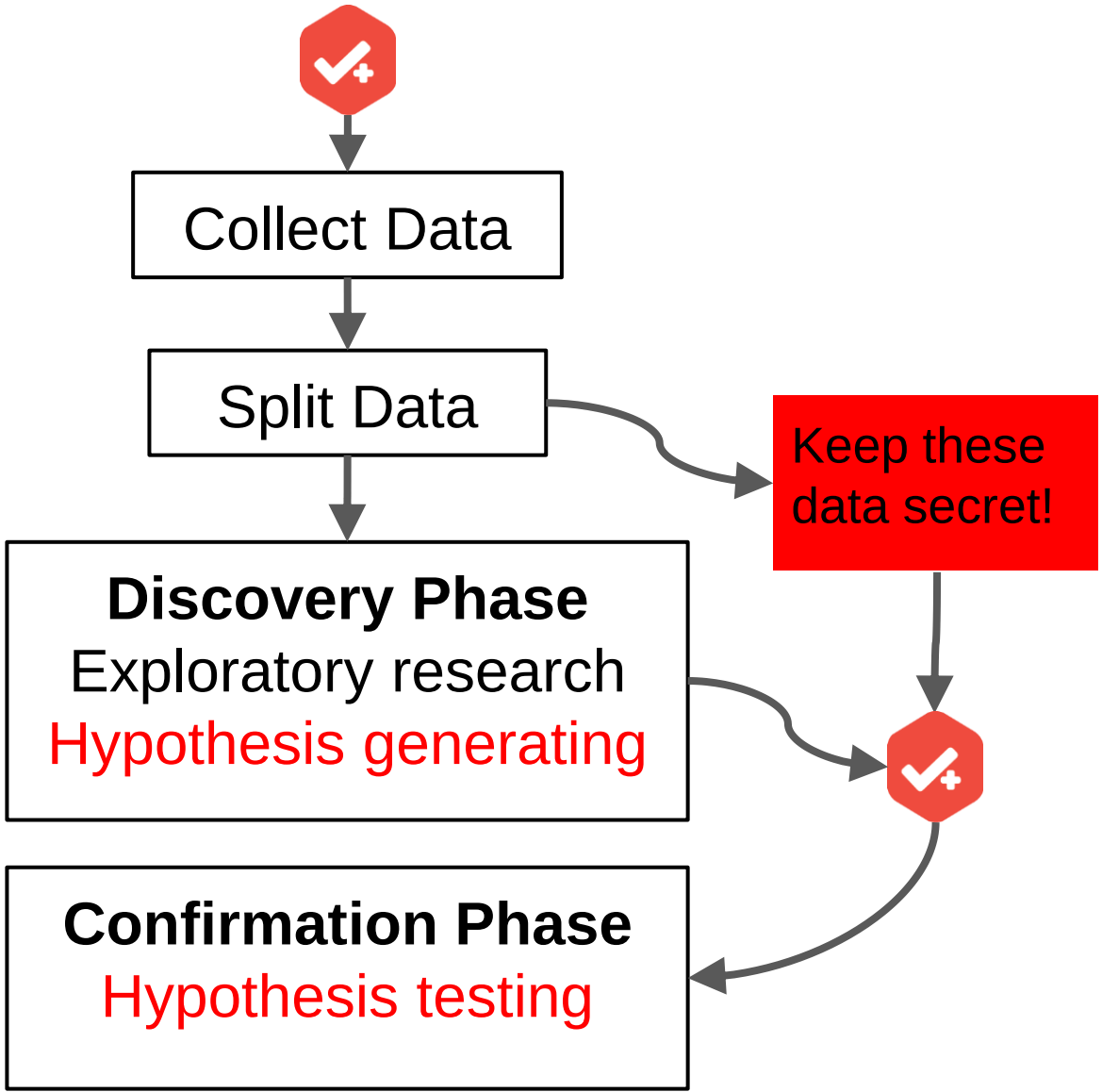
P-values meaningless

Presenting exploratory results as confirmatory increases publishability at the expense of credibility

Example workflow #1
(Theory driven with specific prediction)



Example workflow #2
(Few a-priori predictions)



How do you preregister?

(Make it possible and make it easy!)

https://osf.io/prereg

OSF PREREGISTRATION

Improve your research with preregistration. By writing out specific details such as data collection methods, analysis plans, and rules for data exclusion, you can make important decisions early on and have a clear record of these choices. This can help reduce biases that occur once the data are in front of you.

Use OSF Registries to discover previously registered work.

Start a new preregistration

Continue working on an existing draft preregistration

Preregister a project you already have on OSF

Edit draft registration

Title (required)

Provide the working title of your study. It is helpful if this is the same title that you submit for publication of your final manuscript, but it is not a requirement.

Show Example

Effect of X on Y

Authors (required)

The author who submits the preregistration is the recipient of the award money and must also be an author of the published manuscript. Additional authors may be added or removed at any time.

Show Example

David Mellor

Add +

Research Questions (required)

Please list each research question included in this study.

Show Example

Does increasing X change Y?

Hypotheses (required)

For each of the research questions listed in the previous section, provide one or multiple specific and testable hypotheses. Please state if the hypotheses are directional or non-directional. If directional, state the direction. A predicted effect is also appropriate here.

Show Example

If we increase X by 10%, Y will decrease by 30%

Register

Study Information

Title

Provide the working title of your study. It is helpful if this is the same title that you submit for publication of your final manuscript, but it is not a requirement.

Word Recognition and Cognition

Authors

The author who submits the preregistration is the recipient of the award money and must also be an author of the published manuscript. Additional authors may be added or removed at any time.

Alia Lancaster, L. Robert Slevc

Research Questions

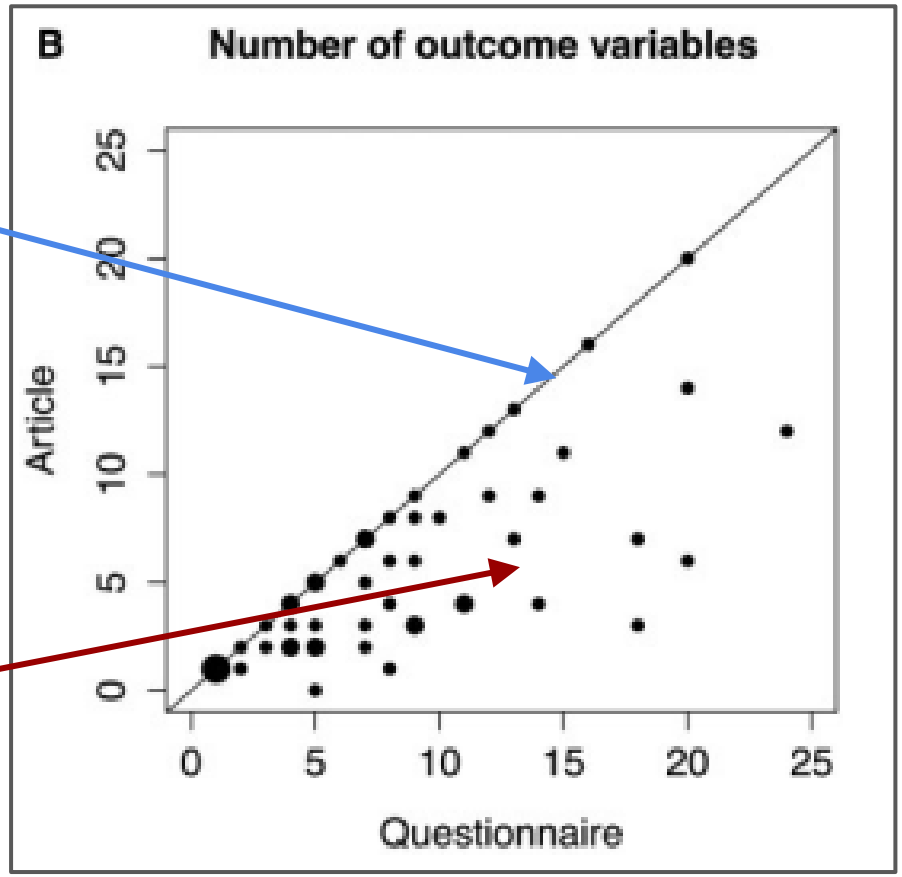
Writing up preregistered work

1. Include a link to your preregistration
2. Report the results of ALL preregistered analyses
3. Label exploratory results
4. Include “Transparent Changes” doc

FAQ: Does preregistration work?

Reported Tests (122)
Median *p*-value = .02
Median effect size (*d*) = .29
% *p* < .05 = 63%

Unreported Tests (147)
Median *p*-value = .35
Median effect size (*d*) = .13
% *p* < .05 = 23%



Underreporting in Political Science Survey Experiments: Comparing Questionnaires to Published Results. Franco, A., Malhotra, N., & Simonovits, G. (2015).


Number of OSF Registrations
25000
20000
15000
10000
5000
0
Make it normative
38
317
1208
3077
6064
12090
22292
2012
2013
2014
2015
2016
2017
2018

Registered Reports

- **Authors submit a Stage 1 manuscript:**
- Introduction
- Proposed Methods & Analyses
- Pilot Data (if applicable)

Registered Reports

If **YES**, then study is granted “in principle acceptance” (IPA), a promise to publish regardless of outcome.

Registered Reports

- **Authors submit Stage 2 Results**
- Introduction and Methods (virtually unchanged)
- Results (new): Registered, confirmatory findings + unregistered, exploratory findings
- Discussion (new)
- Data and materials deposition (ideally)

Registered Reports

- **Reviewers evaluate:**
- Did positive controls succeed?
- Are the conclusions justified by the data?

None of these things matter

Chambers, 2017

Preregistration v. Registered Reports

- Addresses unreported flexibility in conducting statistical analyses.
- Makes a clear distinction between planned, confirmatory research and unplanned, discovery research.

- Address publication bias against null results
- Includes a 2 stage peer review process where methods can be improved prior to conducting a study

Advantages of Registered Reports

Reproducible

- Detailed, repeatable methods
- High statistical power

Transparent

- Often include open data and materials
- Clear distinction between confirmatory and discovery

Credible

- No hindsight bias
- No publication bias or selective reporting
- Allows for null results, which improves meta-analyses

Advantages of Registered Reports

Early peer review

- Occurs when feedback can improve design

More efficient

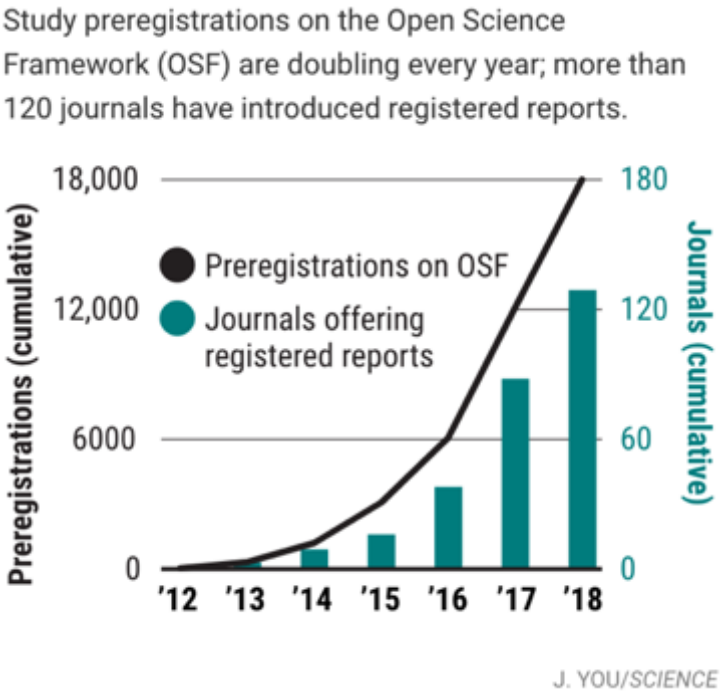
- Shopping an article around wastes author and reviewer time

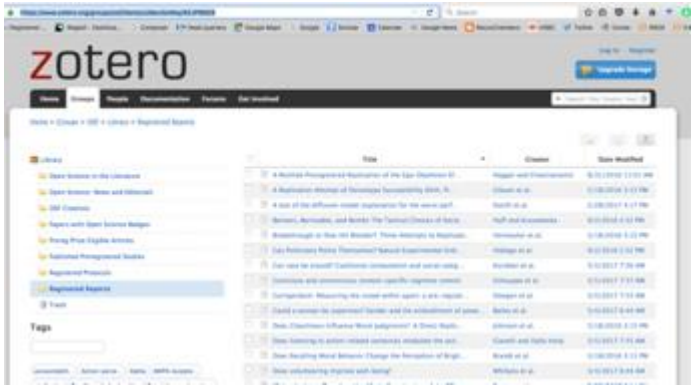
More ideal

- Focused on what science and scientists care about
- More collaborative.

Registered Reports are now mainstream

- **192** journals have adopted them so far
- **Life/medical sciences**: neuroscience, nutrition, psychology, psychiatry, biology, cancer research, ecology, endocrinology, clinical & preclinical medicine
- **Social sciences**: political science, financial and accounting research
- **Physical sciences**: chemistry, physics, computer science





http://bit.ly/zoteroRR

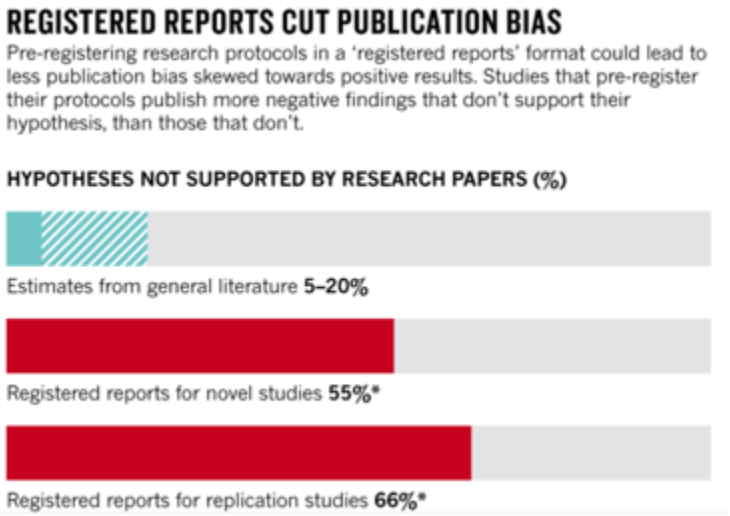
~150 fully completed RRs have been published so far

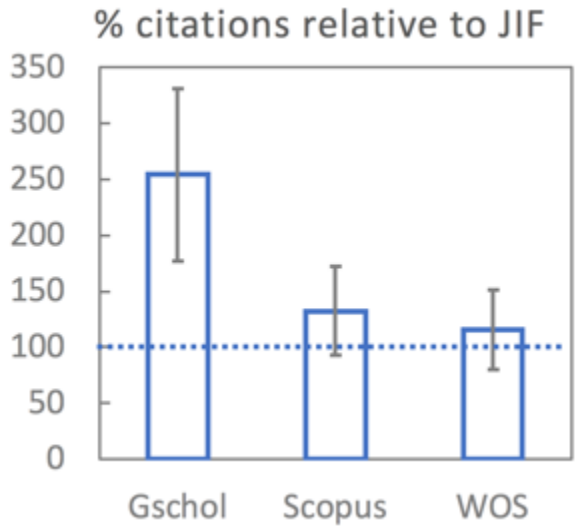
Registered Reports appear to be working as intended

NEWS · 24 OCTOBER 2018

First analysis of 'pre-registered' studies shows sharp rise in null findings

Logging hypotheses and protocols before performing research seems to work as intended: to reduce publication bias for positive results.





Hypotheses at at least three times more likely to be **disconfirmed** in Registered Reports compared with regular articles

Well cited -- at or above respective journal impact factor

https://tinyurl.com/RR-citations

Curated resources hub at cos.io/rr

Transparency and Openness Promotion (TOP) Guidelines

Eight policy statements for increasing the transparency and reproducibility of the published research.

- Agnostic to discipline
- Low barrier to entry
- Modular

See cos.io/top for more detailed language

Three Tiers

1 2 3

Eight Standards

Data citation	✓
Materials transparency	✓
Data transparency	✓
Code transparency	✓
Design transparency	✓
Study Preregistration	✓
Analysis Preregistration	✓
Replication	✓

cos.io/top

Data sharing

1. Article states whether data are available, and, if so, where to access them
2. Data must be posted to a trusted repository. Exceptions must be identified at article submission.
3. Data must be posted to a trusted repository, and reported analyses will be reproduced independently prior to publication.

Preregistration

1. Article states whether a preregistration exists.
2. If a preregistration exists, there is a check prior to results publication to ensure compliance with plan (or transparent changes).
3. Empirical studies must have a preregistration

Signals: Making Behaviors Visible Promotes Adoption

Kidwell et al., 2016

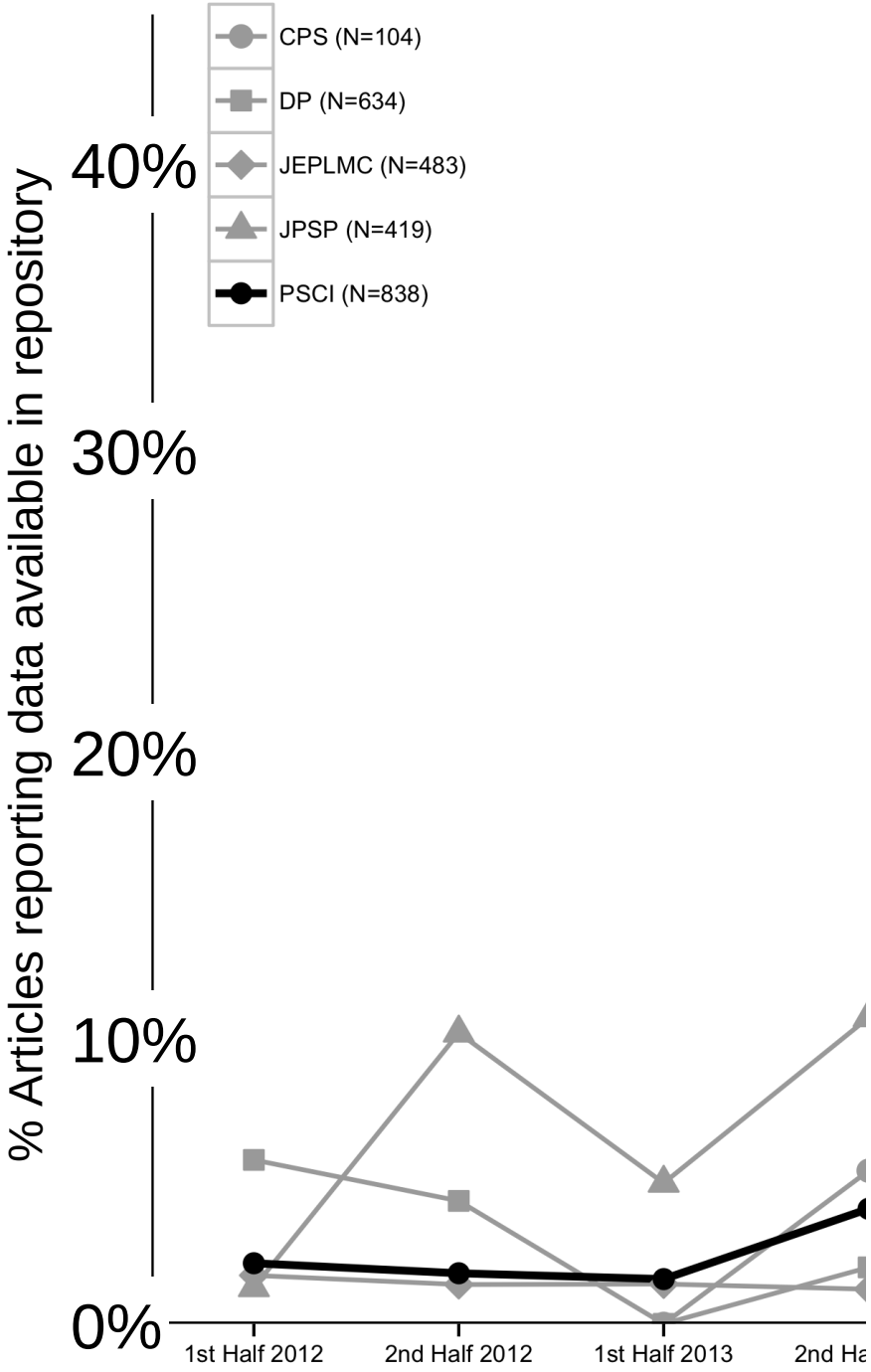
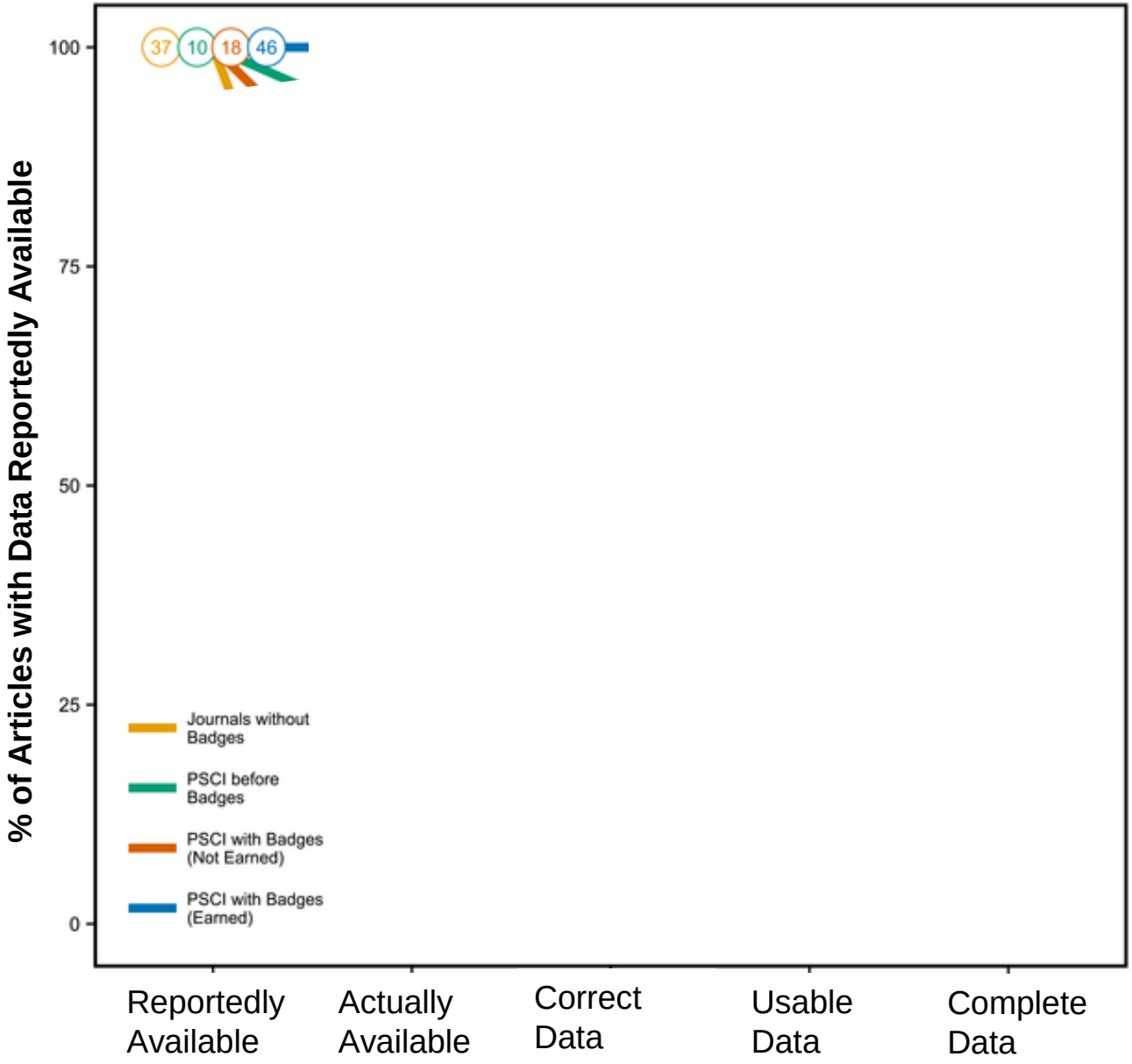

CPS (N=104)
DP (N=634)
JEPLMC (N=483)
JPSP (N=419)
PSCI (N=838)
% Articles reporting data available in repository
40%
30%
20%
10%
0%
1st Half 2012
2nd Half 2012
1st Half 2013
2nd Ha

Fig 4. Actually available, correct, usable, and complete data.



February 13, 2019

aps Psychological SCIENCE

A JOURNAL OF THE ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

OPEN DATA OPEN MATERIALS PREREGISTERED

Volume 30 | Number 2 | February 2019

*The links below take you to the journal via the APS website. If not already logged in, you will be redirected to log-in using your last name and Member ID **(16341)**. Be sure to download pictures to see Open Science badges.*

RESEARCH ARTICLES

Thank you!

Resources for Registered Reports, preregistration, Open Science Badges, at https://cos.io

Find me online @EvoMellor or email: david@cos.io

Find this presentation at:
https://osf.io/m28gf