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How Psychology deals with Open Science
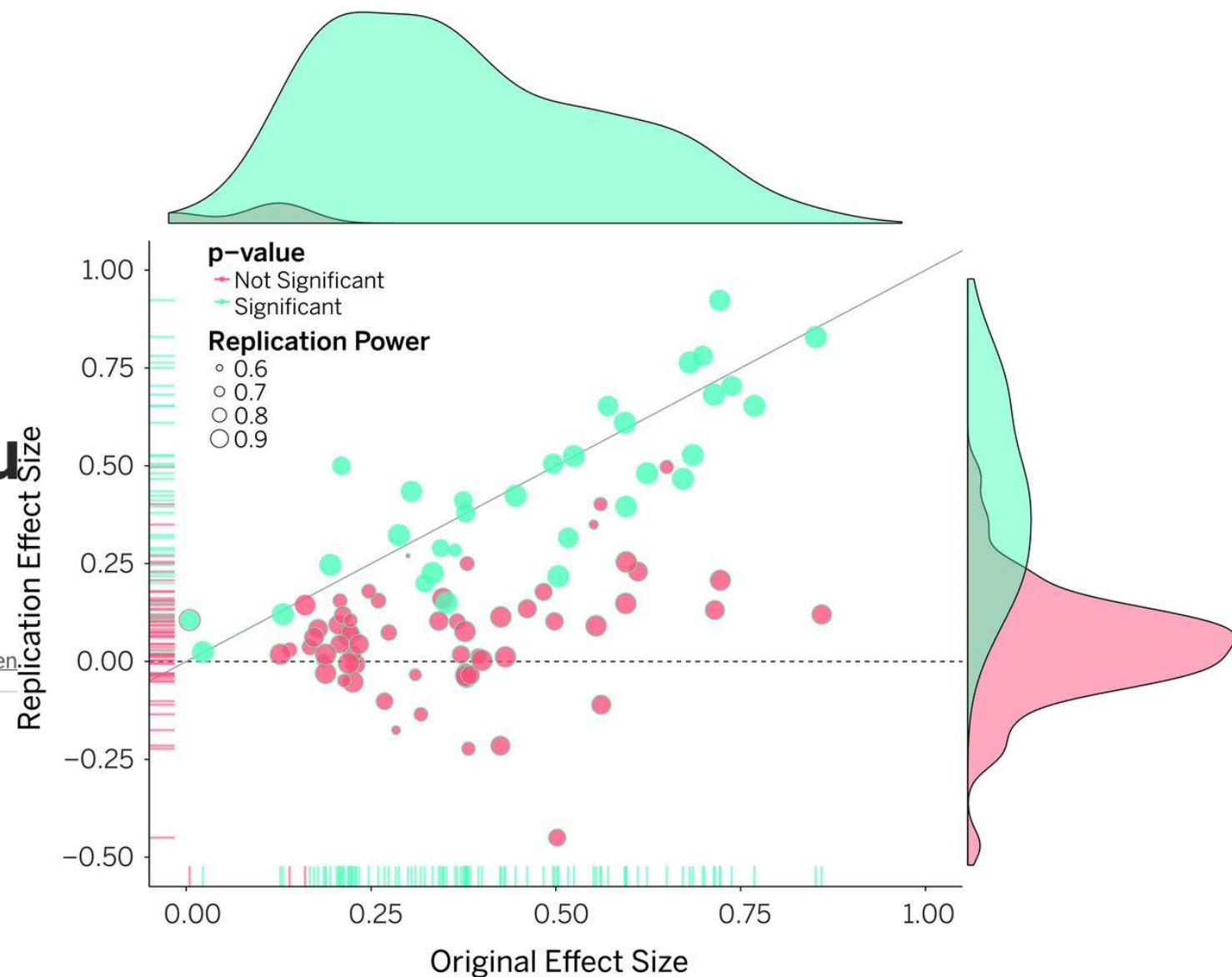
Principles and practices

Open and reproducible science

- "Open science" (Munafò et al., 2017)

  - Making the content and process of producing evidence and claims transparent and accessible to others

- Reproducibility (Goodman, Fanelli & Ioannidis, 2016)

  - Methods

  - Results ("replication")

  - Inferential

Threats to reproducible science

nature human behaviour

A manifesto for reprod

Marcus R. Munafò[1,2]*, Brian A. Nosek[3,4], Doro
Christopher D. Chambers[7], Nathalie Percie du
Jennifer J. Ware[11] and John P. A. Ioannidis[12,13,1]

Publish and/or
conduct next experiment
Publication bias

Generate and
specify hypothesis
Failure to control for bias

HARK'ing

Interpret results
P-hacking

Design study
Low statistical power

Analyse data and
test hypothesis
P-hacking

Conduct study and
collect data
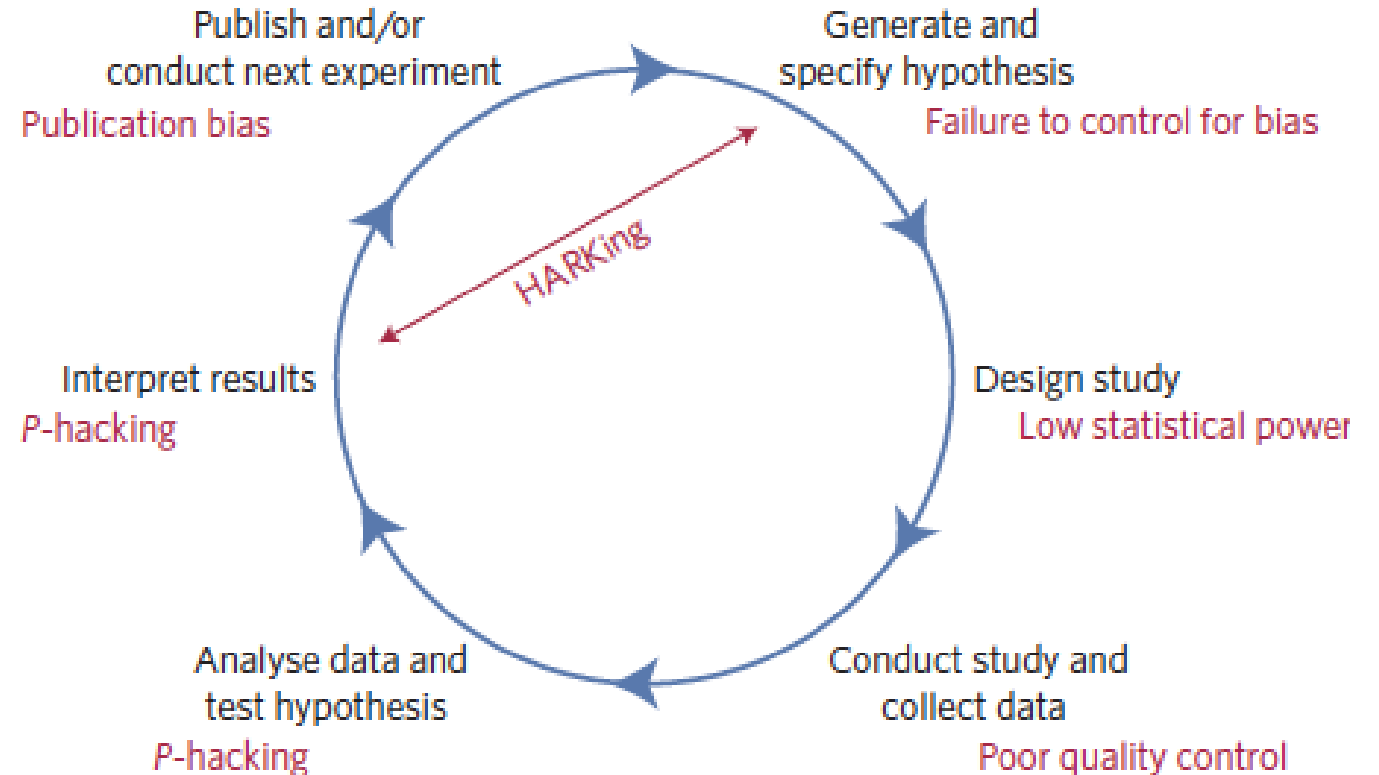Poor quality control

Table 1 | A manifesto for reproducible science.

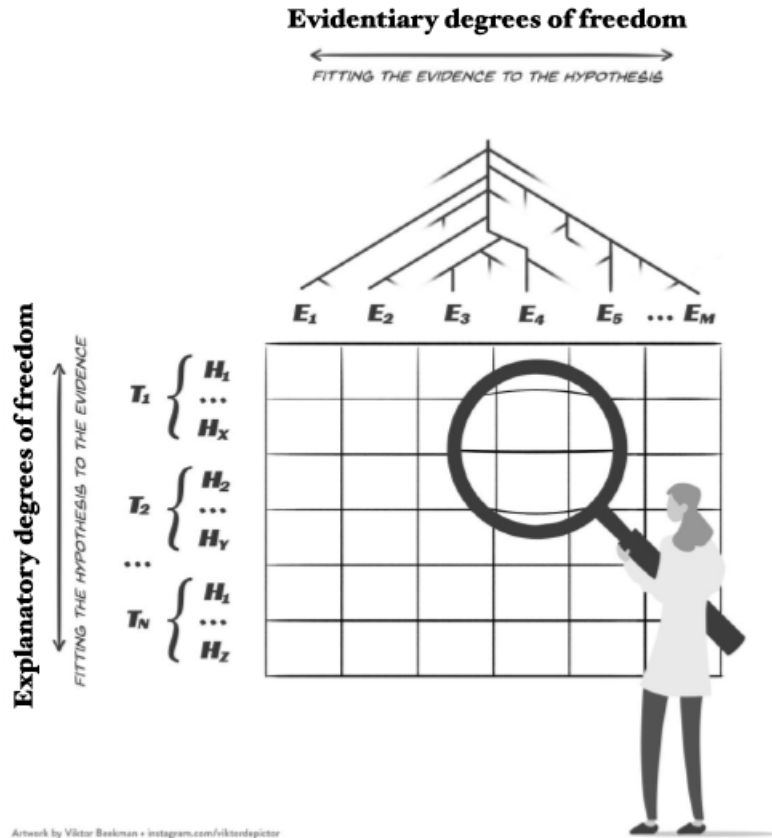| Theme	Proposal	Examples of initiatives/potential solutions (extent of current adoption)	Stakeholder(s)
Methods	Protecting against cognitive biases	All of the initiatives listed below (* to ****) Blinding (**)	J, F
	Improving methodological training	Rigorous training in statistics and research methods for future researchers (*) Rigorous continuing education in statistics and methods for researchers (*)	I, F
	Independent methodological support	Involvement of methodologists in research (**) Independent oversight (*)	F
	Collaboration and team science	Multi-site studies/distributed data collection (*) Team-science consortia (*)	I, F
			J, F
			J
		**) and non-financial	J
		so on (* to **) als, * for other studies)	J, F, R
		ural sciences,	J
		ew, for example, Publons,	
			J, I, F
		Transparency and Openness Promotion guidelines (*) Funding replication studies (*) Open science practices in hiring and promotion (*)	

Estimated extent of current adoption: *, <5%; **, 5–30%; ***, 30–60%; ****, >60%. Abbreviations for key stakeholders: J, journals/publishers; F, funders; I, institutions; R, regulators.

A manifesto for reproducible science

Marcus R. Munafò[1,2]*, Brian A. Nosek[3,4], Dorothy V. M. Bishop[5], Katherine S. Button[6], Christopher D. Chambers[7], Nathalie Percie du Sert[8], Uri Simonsohn[9], Eric-Jan Wagenmakers[10], Jennifer J. Ware[11] and John P. A. Ioannidis[12,13,14]

Reporting and dissemination

- Prospective registration (clinical trials):
  - Public documentation of trial protocols before enrollment of 1st patient (ICMJE, 2005)

- Preregistration (psychology)
  - Declaring study plans (e.g., hypotheses, methods, and analyses) in a public registry before study commencement (Hardwicke & Wagenmakers, 2021)

Preregistration

Evidentiary degrees of freedom
FITTING THE EVIDENCE TO THE HYPOTHESIS

Explanatory degrees of freedom
FITTING THE HYPOTHESIS TO THE EVIDENCE

E_1 E_2 E_3 E_4 E_5 ... E_M

T_1 { H_1 ... H_X }
T_2 { H_2 ... H_Y }
...
T_N { H_1 ... H_Z }

Artwork by Viktor Beekman · instagram.com/viktordepictor

- **Functions of preregistration**
 - Reduce bias by enabling results-independent research decisions
  - Calibrate confidence by enabling an informed assessment of the risk of bias

- Bias reduction depends on how comprehensively **decisions are specified** in the preregistration

Hardwicke & Wagenmakers, 2021

Evaluation of preregistration

- Trials of psychological interventions for depression with enrolment after ICMJE 2005 registration mandate
- 75/185 (40%) prospectively registered
  - 11/75 (15%) without specifying outcomes or assessment time points

- Studies with preregistered badges in *Psychological Science* 2015-2017
- 2/27 studies no deviation
- 1/27 disclosed all deviations

Miguel et al., 2021
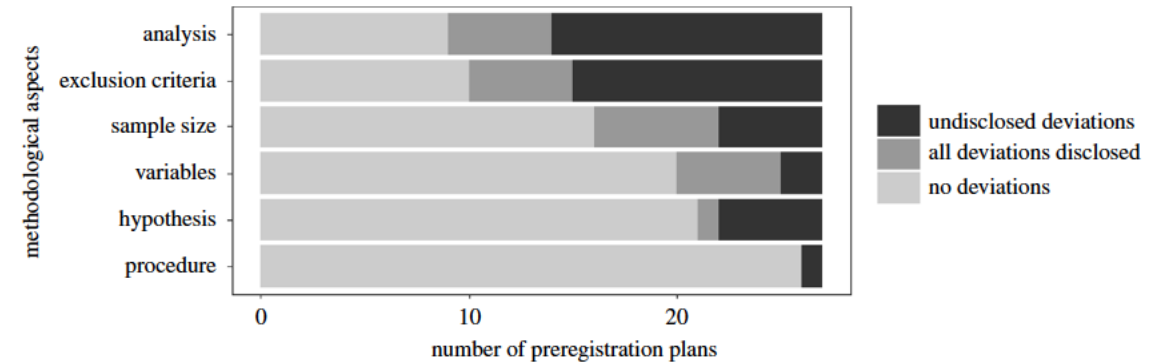
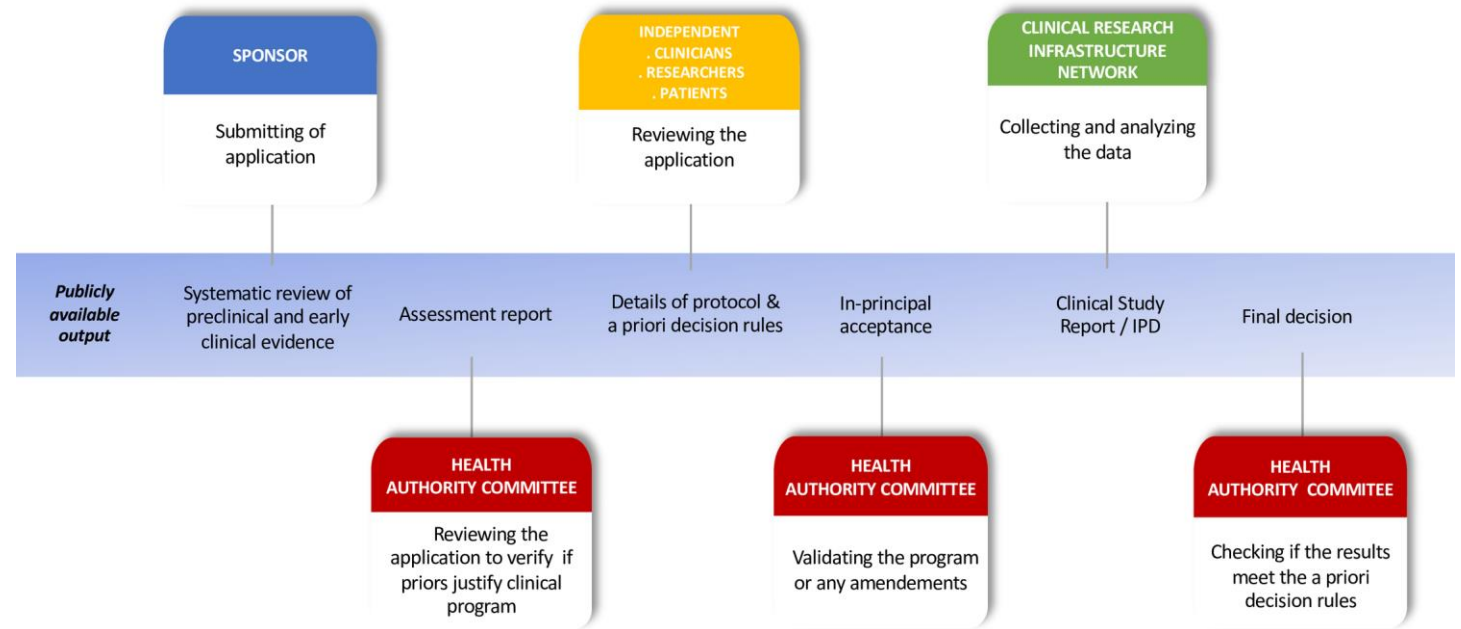Claesen et al. , 2021

Registered reports

- Form of empirical publication in which study proposals are peer-reviewed and pre-accepted **before** research is undertaken
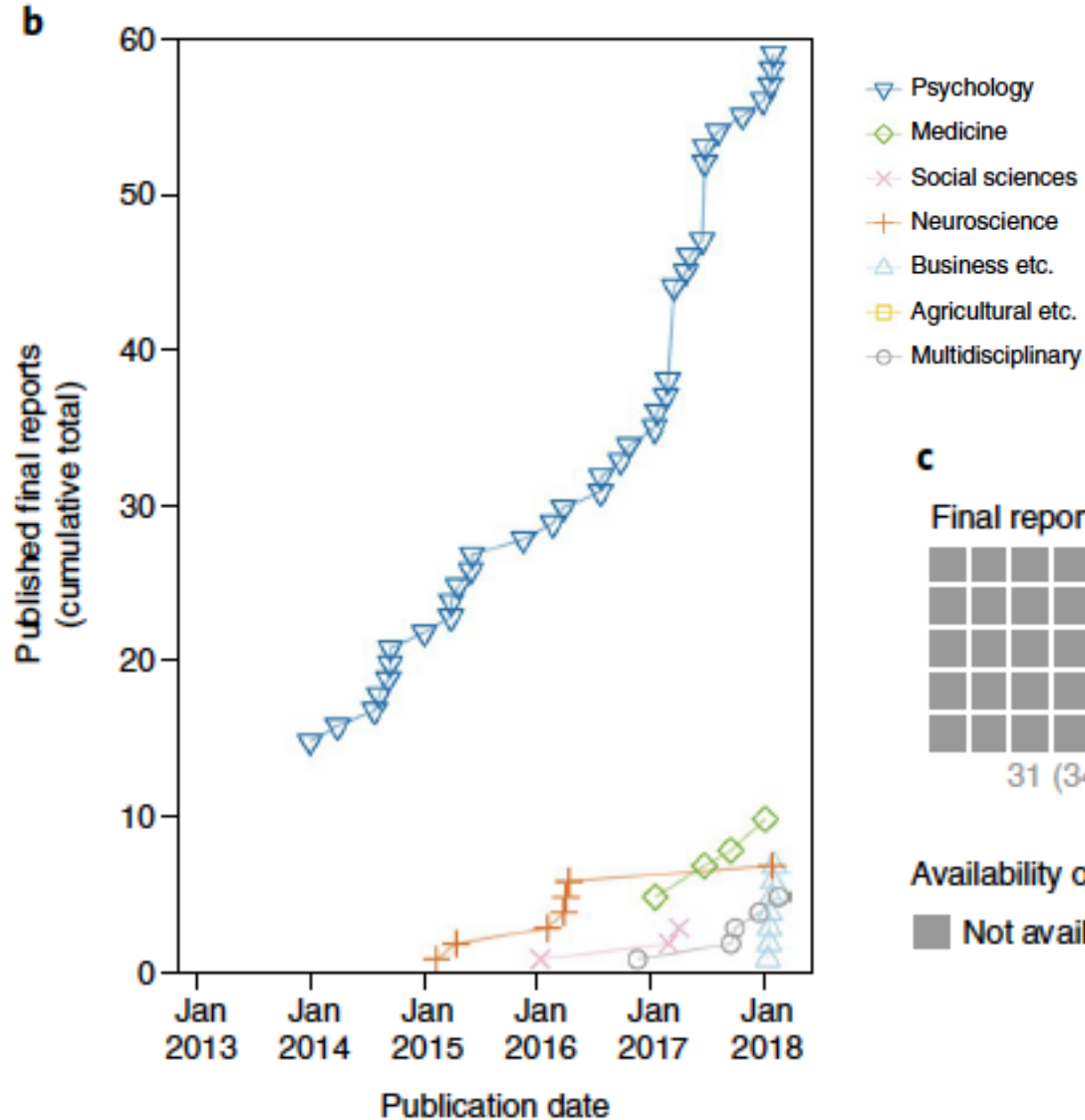

Chambers & Tzavella, 2021

Registered drug approval

- "Golden" approval pathway
- **<u>Any trial</u>** intended to support drug approval should be submitted as registered report
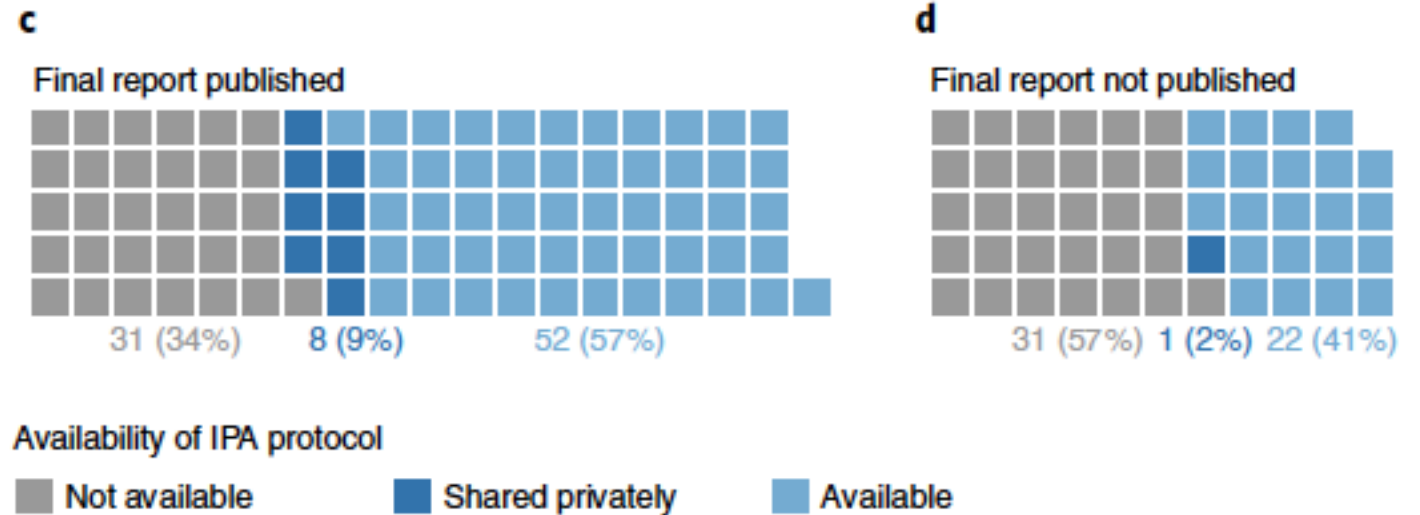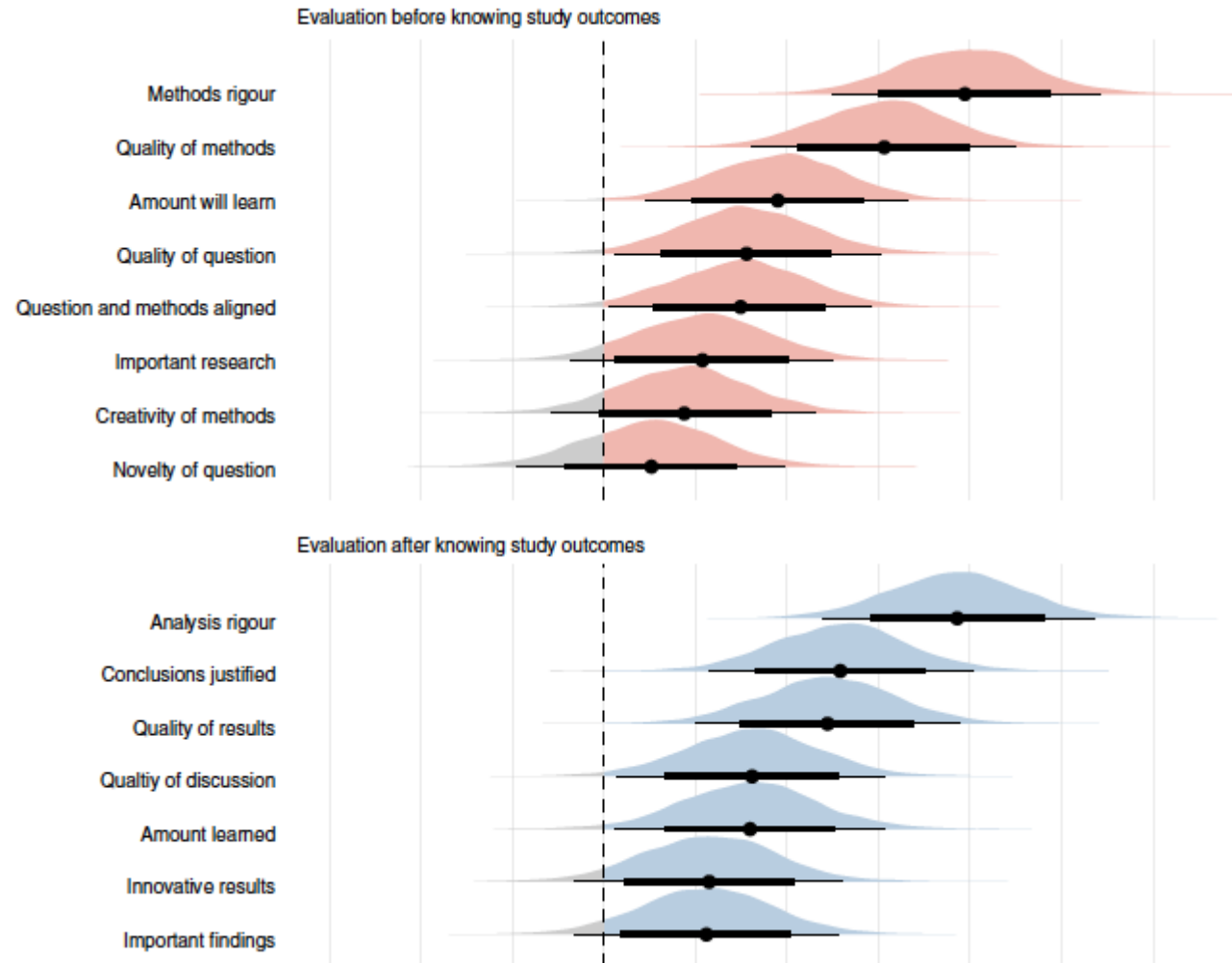

Naudet et al., 2021

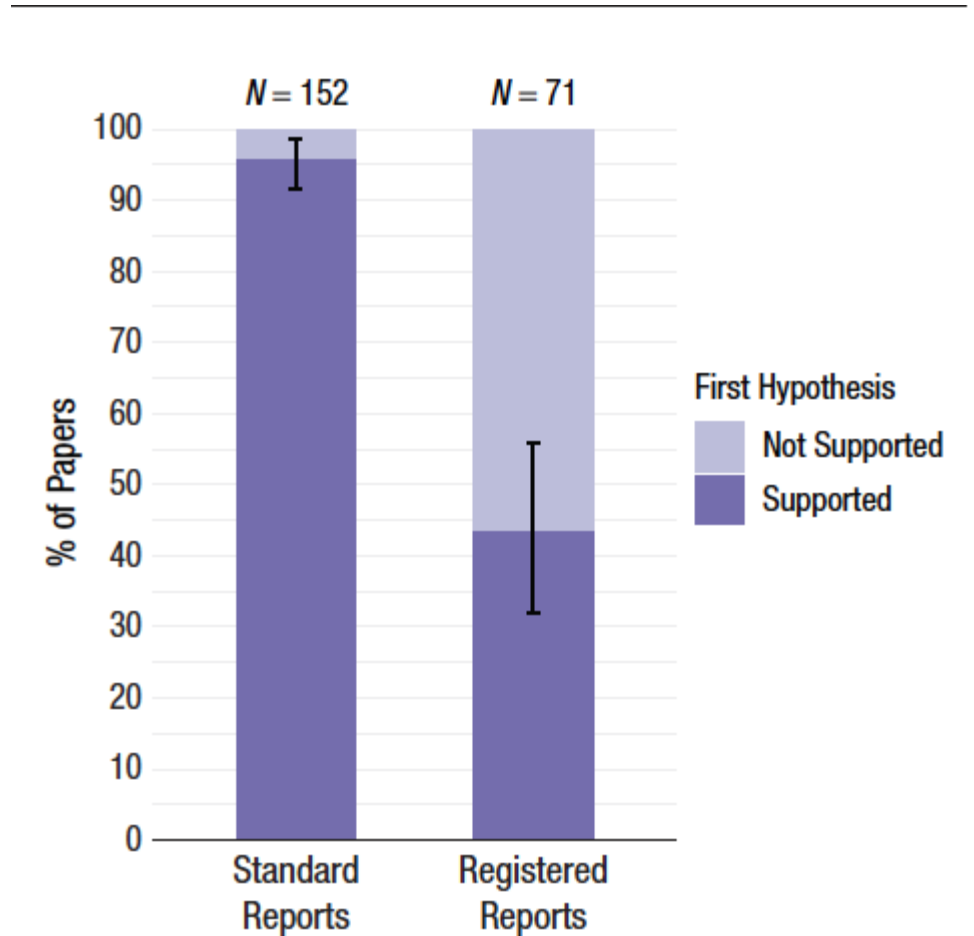# Evaluation of registered reports: transparency

Hardwicke & Ioannidis, 2018

Evaluation of registered reports: quality

Evaluation before knowing study outcomes

Methods rigour
Quality of methods
Amount will learn
Quality of question
Question and methods aligned
Important research
Creativity of methods
Novelty of question

Evaluation after knowing study outcomes

Analysis rigour
Conclusions justified
Quality of results
Qualtiy of discussion
Amount learned
Innovative results
Important findings

Difference between RR and non-RR articles

N = 152   *N* = 71

First Hypothesis
Not Supported
Supported

% of Papers

Standard Reports   Registered Reports

Soderberg et al., 2021

Scheel et al., 2021

Incentives

- Badges to acknowledge open science practices (Center for Open Science)
  - Preregistration
  - Data sharing
  - Material sharing

Daniel Feiler, Johannes Müller-Trede

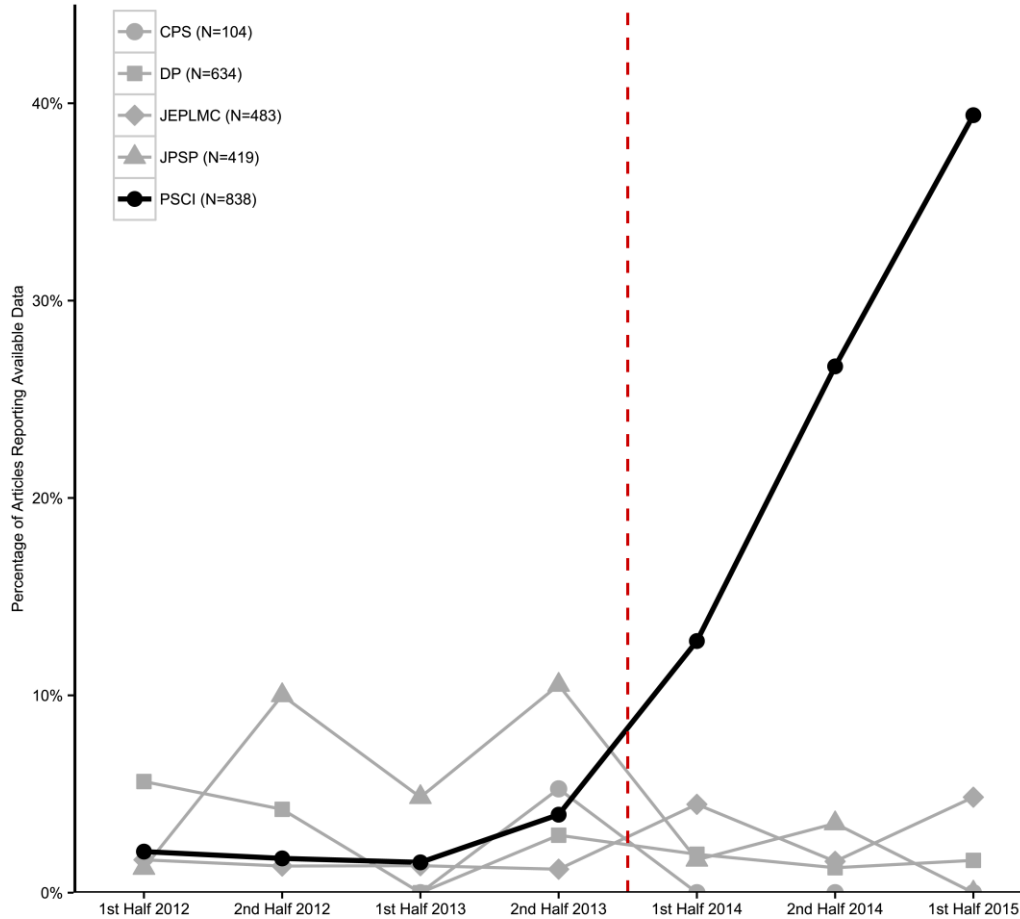First Published January 21, 2022 | Research Article | Check for updates

https://doi.org/10.1177/09567976211032657

Article information ˅

Altmetric 7

Evaluation of badges

- Randomized trial *BMJ Open*

- Information about data sharing policy + open data badge vs information alone

- Primary outcome: data sharing rate (N papers sharing/total N papers)

- 160 research articles

- Odds of awarding badges similar (OR= 0.9, 95% CI 0.1 to 9.01)

- 2 datasets shared in each group

Kidwell et al., 2016; Farid et al., 2020

New proposals: Discrepancy review

- Peer review intervention to reduce undisclosed discrepancies between registrations and publications

- Feasibility study for incorporating discrepancy review as a regular practice at journals and conducting a randomized trial

Box 1. Summary of the eight questions guiding the updated discrepancy review process.

1. Does the manuscript present only **exploratory** outcomes and analyses?
2. Is the registration **properly registered** (i.e., permanent and public)?
3. Does the registration date suggest that the timing of registration may be **retrospective**?
4. Are there discrepancies in the number, content, or prioritization of **hypotheses**?
5. Do the study arms, **independent variables**, exposure variables, or study/experimental grouping match?*
6. Are there discrepancies in the number, content, or prioritization of **outcome measures**?
7. Do the **analyses** match?*
8. While answering the previous questions, if you identified notable **additional discrepancies** or questionable research practices you may raise them. These could include sample size, control variables, covariates or moderators, eligibility criteria, analytic decisions (e.g., outlier definition), randomization, blinding, and data preprocessing, among others.*

*For these items, reviewers were instructed to not spend time looking for minor discrepancies.

TARG meta-research group et al, 2022

Thank you!
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