REGISTERED REPORTS

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ReproducibiliTea

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VU VRIJE UNIVERSITEIT AMSTERDAM

Which part of a research study do you believe should be beyond your control as a scientist?

The results

Which part of a research study do you believe is most important for publishing in ‘top journals’ & advancing your career?

The results

https://doi.org/10.5281/zenodo.3686714

Don’t touch THIS

Which part of a research study do you believe should be beyond your control as a scientist?

The results

But make sure THIS is amazing

Which part of a research study do you believe is most important for publishing in ‘top journals’ & advancing your career?

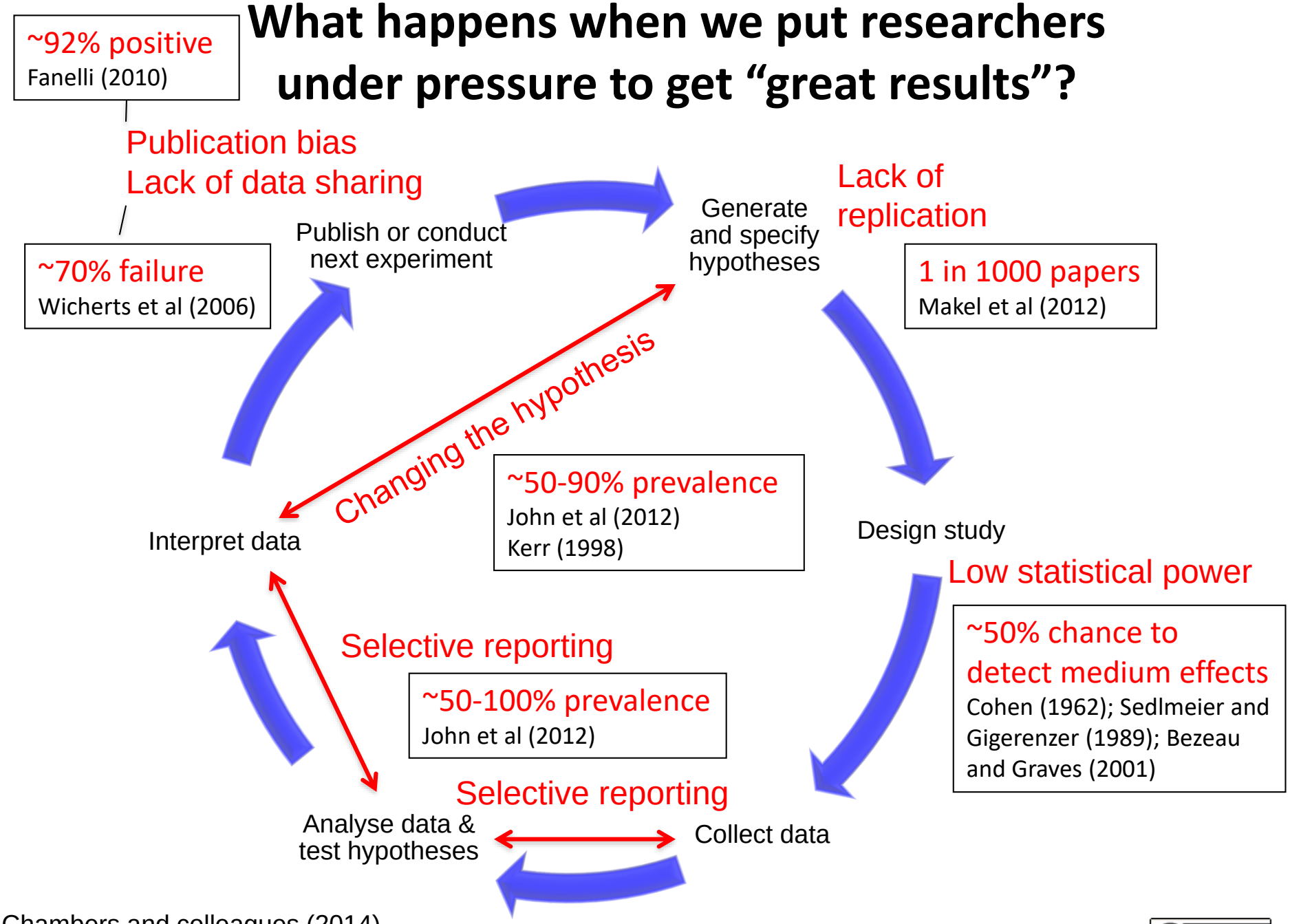
The results

Slide by Chris Chambers: https://osf.io/pkm67/

Results-driven culture distorts incentives

Nosek, Spies & Motyl (2012) https://doi.org/10.1177/1745691612459058
Edwards and Roy (2017) https://doi.org/10.1089/ees.2016.0223
Chambers and colleagues (2014) https://doi.org/10.3934/Neuroscience2014.1.4

What happens when we put researchers under pressure to get "great results"?



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REGISTERED REPORTS

Publishing format where **research question and the quality of methodology are central** by conducting peer review prior to data collection.

-> results are a dead currency in quality evaluation

Slide by Chris Chambers: https://osf.io/pkm67/

None of these things matter

Slide by Chris Chambers: https://osf.io/pkm67/

ADVANTAGES

Reproducible

- Detailed, repeatable methods
- High statistical power (2-3x > sample sizes)

Transparent

- Accompanied by open data & materials
- Outcomes of confirmatory and exploratory analyses distinguished

Credible

- No publication bias
- No hindsight bias
- No selective reporting

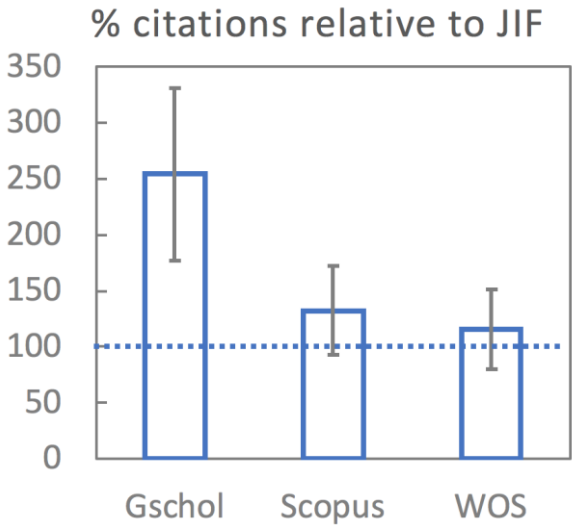
Obels et al. 2019
https://doi.org/10.31234/osf.io/fk8vh
Hardwicke et al. 2018
https://doi.org/10.1098/rsos.180448

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

Slide by Chris Chambers: https://osf.io/pkm67/

ADVANTAGES

- Get **expert reviewer feedback** when it's most useful
- Higher **acceptance rate**
  - More likely to get accepted in the 1st journal you submit to
- Get paper **accepted before you start the research**, regardless of the eventual results
- Article **well cited** (above impact factor)



https://tinyurl.com/RR-citations
Hummer et al. 2017
https://doi.org/10.31219/osf.io/5y8w7

Slide by Chris Chambers: https://osf.io/pkm67/

REGISTERED REPORTS ARE MAINSTREAM NOW

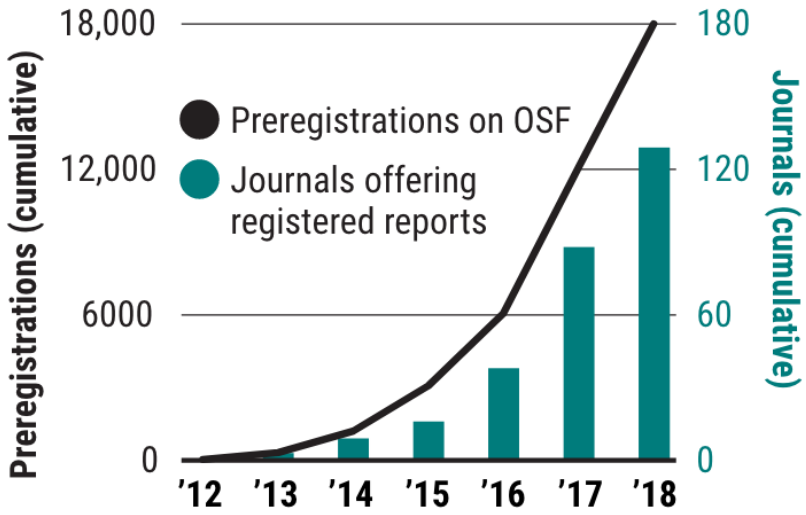
- Offered by 225 journals
- ~150 stage 2 articles so far published by 54 outlets

ttps://www.zotero.org/groups/osf/items/collectionKey/KEJP68G9

Chambers and Tzavella 2020

https://doi.org/10.31222/osf.io/43298

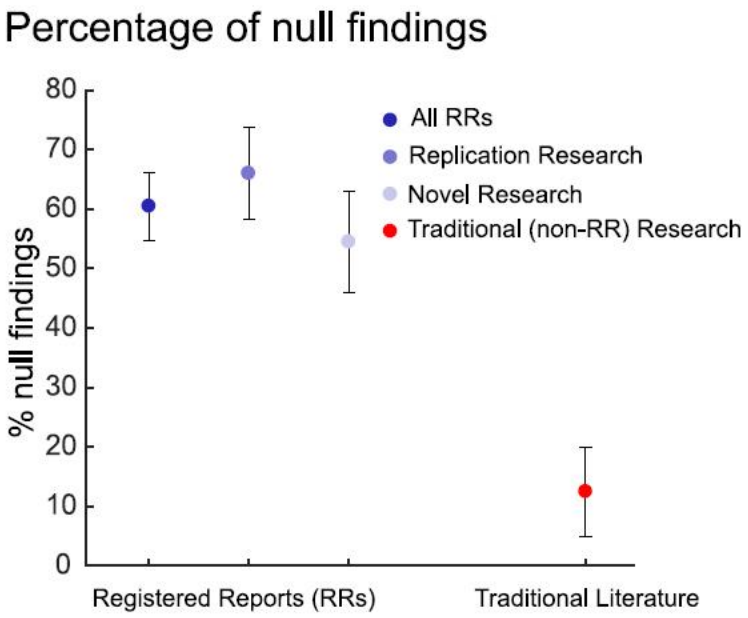
Study preregistrations on the Open Science Framework (OSF) are doubling every year; more than 120 journals have introduced registered reports.

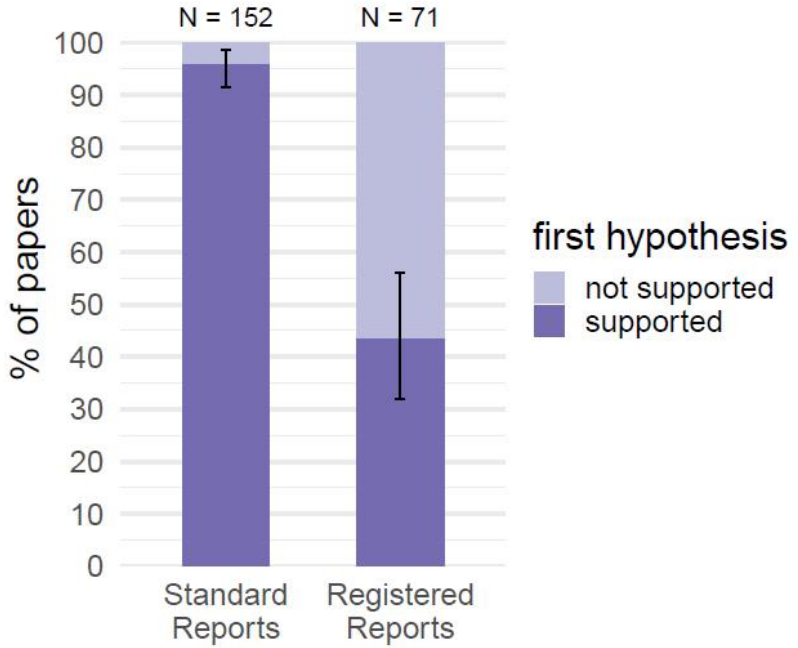


J. YOU/*SCIENCE*

Original Slide by Chris Chambers: https://osf.io/pkm67/

WORKING AS INTENDED



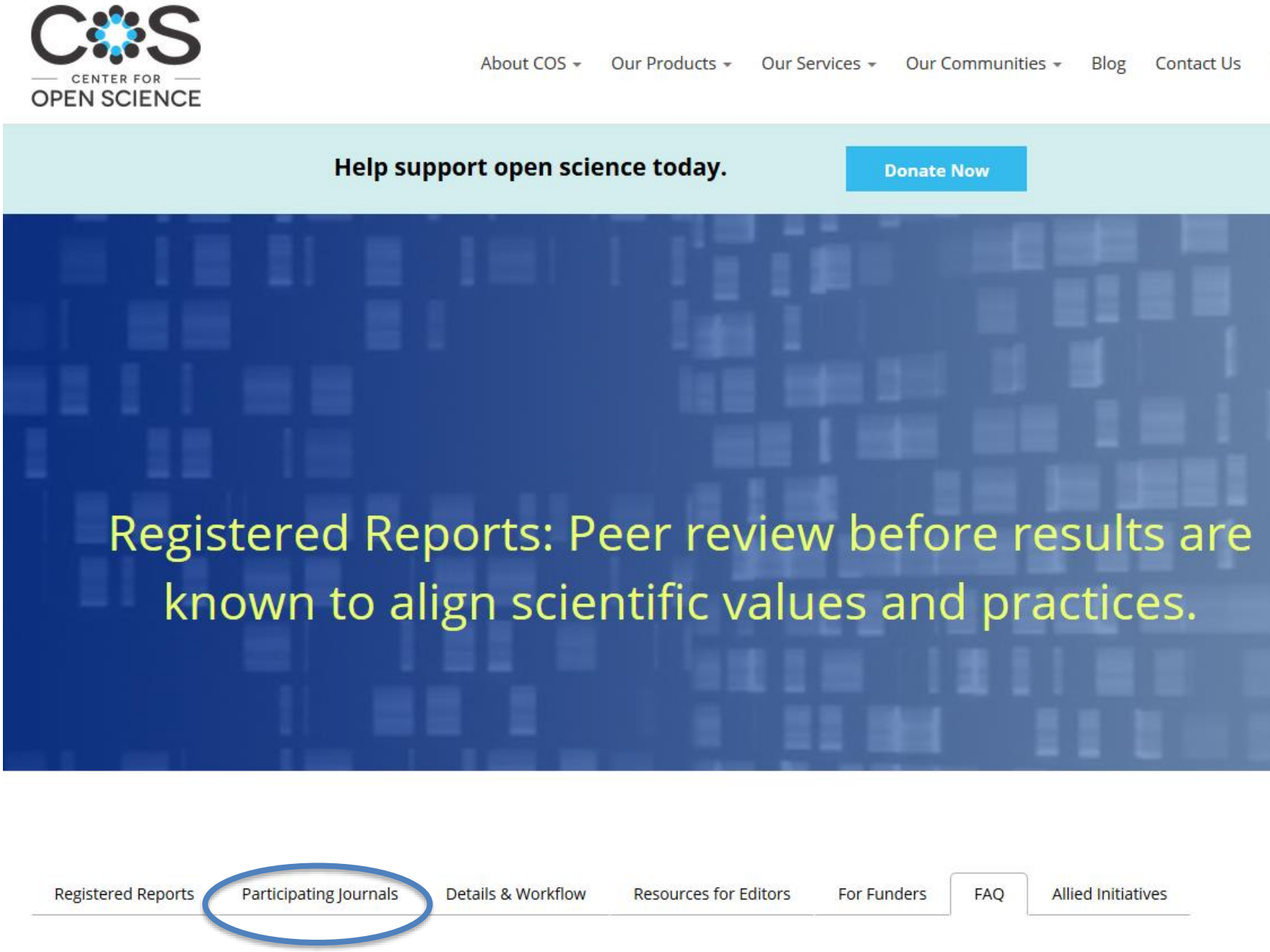


Hypotheses are **~5 times more likely to be unsupported** in RRs
Allen and Mehler 2019
https://doi.org/10.1371/journal.pbio.3000246

96% positive results in standard publications, only **44% positive results** in RRs
Scheel et al. 2020
https://doi.org/10.31234/osf.io/p6e9c

Summary on Twitter

https://cos.io/rr/



ARE REGISTERED REPORTS SUITABLE FOR MY RESEARCH?

Applicable to any field engaged in **hypothesis-driven research** where one or more of the following problems apply:

- **Publication bias**
- **Significance chasing (e.g. *p*-hacking)**
- ***Post hoc* hypothesizing (hindsight bias)**
- **Low statistical power**
- **Lack of close replication**

- Not applicable for
  - **Purely exploratory science**
  - **Methods development**

} No hypothesis testing

COULD RESEARCHERS CHEAT BY 'PRE-REGISTERING' A STUDY THAT THEY HAVE ALREADY CONDUCTED?

- **Time-stamped raw data files must be submitted** at Stage 2 with basic lab log and certification from all authors that data was collected after provisional acceptance
- Submitting a completed study at Stage 1 would therefore be **fraud**
- Strategy would backfire anyway when reviewers ask for amendments at Stage 1

Registered Reports aren't designed to prevent fraud but to incentivize good practice

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

WILL THIS LIMIT EXPLORATORY RESEARCH?

- No. **There are no restrictions on the reporting of unregistered exploratory analyses.**
- Confirmatory and exploratory analyses are simply reported **separately** in the final paper

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

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ARE REGISTERED REPORTS SUITABLE FOR ME AS AN EARLY CAREER RESEARCHER?

- They send a signal that the researcher cares about **transparency and reproducibility**
- They are offered at **prominent journals** (publishers such as Royal Society, Nature, APA, PLOS ONE)
- 78% of submitted RRs were **led by ECRs** at *Cortex* compared with 67% for a comparison sample of regular articles
  (Chambers and Tzavella 2020, https://doi.org/10.31222/osf.io/43298)
- Going for post doc jobs, what you do think will look better on your **CV**?

  A) Papers listed as “in preparation”, “submitted”, “submitted to *Nature*”

  B) Papers listed as “provisionally accepted at *[Journal]*”

WHAT IS THE ACCEPTANCE RATE?

- For standard (unregistered) research articles, the rejection rate at *Cortex* is about 90%
- But for Registered Reports, only **10%** of submissions that pass editorial triage are rejected
- The rejection rate for Stage 2 submissions is currently **0%**

HOW LONG DOES REVIEW TAKE?

- Generally about **2-4 months**. e.g. at Cortex:
  - Average **9 weeks to complete Stage 1 review**
    - not including time taken for authors to revise manuscript
  - Average **9 weeks to complete Stage 2 review**
    - not including time taken for authors to revise manuscript

Slide by Chris Chambers: https://osf.io/pkm67/

WHAT HAPPENS IF I NEED TO CHANGE SOMETHING ABOUT MY STUDY PROCEDURES AFTER THEY ARE PROVISIONALLY ACCEPTED?

- **Minor changes** (e.g. replacing equipment) can be footnoted in Stage 2 manuscript as protocol deviations
- **Major changes** (e.g. changing data exclusion criteria) are likely to require withdrawal and re-review

Editorial team decides whether deviation is sufficiently minor to continue

SOME OF MY ANALYSES WILL DEPEND ON THE RESULTS, SO HOW CAN I PRE-REGISTER EACH STEP IN DETAIL?

- Pre-registration doesn't require each decision to be specified, only the decision *tree*
- Authors can pre-register the contingencies / rules for future decisions
- Pilot data or modelling can be useful for narrowing the range of likely possibilities

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

Slide by Chris Chambers: https://osf.io/pkm67/

HOW DO REGISTERED REPORTS SUPPORT REPLICATION STUDIES?

- Conspiracy of circumstances tells us not to bother doing direct (close) replications
  - Method sections are often too vague to allow precise replication
  - Chronic lack of power in novel research means that replications often require very large samples sizes
  - Attempting to exactly repeat a previous experiment can be seen in some fields (e.g. psychology) as an act of aggression (cf. physics)
  - Motivated reasoning by reviewers can impede publication
  - Many journals prioritise novelty and see replications as unpublishable

Slide by Chris Chambers: https://osf.io/pkm67/

HOW DO REGISTERED REPORTS SUPPORT REPLICATION STUDIES?

- RRs: have proposed replication experiment reviewed and provisionally accepted *before* you invest substantial resources into doing it; potentially involve original authors in peer review of the protocol; **motivated reasoning is prevented**

Slide by Chris Chambers: https://osf.io/pkm67/

I HAVE NO IDEA OF WHAT EFFECT SIZE TO EXPECT IN MY EXPERIMENT, SO HOW CAN I DO A POWER ANALYSIS AS PART OF STAGE 1?

- **Pilot results** to help inform effect size estimates are welcomed in Stage 1
- Usually there is related literature or you can specify a smallest effect size of interest (SESOI).
- If SESOI is uncertain, options are:
  - an orthodox statistical approach with corrected peeking
    - (e.g. Lakens, D. Performing high-powered studies efficiently with sequential analyses. *European Journal of Social Psychology* 44.7 (2014): 701-710)
  - Bayesian methods to specify distribution of possible effect sizes
    - (e.g. Dienes, Z. Bayesian versus orthodox statistics: Which side are you on? *Perspectives on Psychological Science* 6.3 (2011): 274-290)

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

Slide by Chris Chambers: https://osf.io/pkm67/

COULD REVIEWERS SCOOP ME?

- Usually only a handful of people know about Stage 1 submissions at point of review
- Once a Stage 1 protocol is accepted, the **journal can't reject your paper** because something similar was published (novelty becomes irrelevant)
- Manuscript received date on many published RRs is the date of Stage 1 submission
- How different from grant applications, conference presentations, seminars?
- In 7 years there have been **no reports of scooping**, and Stage 1 protocols can be kept under private embargo until Stage 2 submission or acceptance.
  Chambers and Tzavella 2020 (https://doi.org/10.31222/osf.io/43298)

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

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REGISTERED REPORTS SEEM LIMITED TO SINGLE STUDIES. WHAT IF I WANT TO PUBLISH A SEQUENCE OF EXPERIMENTS?

- Many journals offer **sequential registrations** in which authors add studies iteratively at Stage 1 via a fast-track mechanism and complete them at Stage 2
  - With each completed cycle, the previous accepted version of the paper is guaranteed to be published
- Authors can also include a sequence of unregistered experiments as preliminary studies in a Stage 1 RR
  - e.g. E1, E2, E3 preliminary; manuscript proposes E4 as pre-registered test: http://rsos.royalsocietypublishing.org/content/4/9/160935

Slide by Chris Chambers: https://osf.io/pkm67/

HOW DO I CONVINCE MY PI/SUPERVISOR TO TRY REGISTERED REPORTS?

- Explain the **wider community** benefits as well as potential **benefits for your career**
- **RRs are useful for providing clarity and avoiding stonewalling by rivals** who may object to your results
- Are offered by **major journals and well cited**, with numbers continually rising
- Are part of transparency initiatives that only going to increase in prominence
- If you're the first in your field, you can be considered as a **front runner**

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SELFISH REASONS FOR PRE-REGISTRATION

Leif Nelson

…I am not saying, "you have to preregister or else!" Heck, I am not even saying that you should; I am saying that I should. In a world of transparent reporting, I choose preregistration as a way to selfishly show off that I predicted the outcome of my study.

DATA COLADA

Thinking about evidence, and vice versa

PRE-REGISTRATION IN PSYCHOLINGUISTICS

Shravan Vasishth (Potsdam University)

@shravanvasishth

- Slower data collection and publication:
  - 7 papers in 2018
  - 6 in 2017
  - 11 in 2016
  - 10 in 2015
- Discuss the ambiguities of the results openly in papers.
- Releasing data caught mistakes before publication.
- “Overall, I feel that the quality of our work has improved.”

https://vasishth.github.io/MPILeipzig2019/

REGISTERED REPORTS

Instead of "playing the game" it is time to change the rules: Registered Reports at AIMS Neuroscience and beyond

Chambers, Christopher D., Feredoes, Eva, Muthukumaraswamy, Suresh Daniel and Etchells, Peter. 2014. AIMS Neuroscience 1 (1) , pp. 4-17.

Chris Chambers
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Eva Fredoes
@evaferedoes

Suresh
Muthukumaraswam

Peter J. Etchells
@PeteEtchells

QUESTIONS? DISCUSSION!

- Do you think Registered Reports are feasible for your research?
- Do you have any concerns?

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DUMPING GROUND

Won’t Registered Reports become a dumping ground for negative or ambiguous findings that have little impact?

- RRs that include null hypothesis significance testing (NHST)-based analyses must include *a priori* power of ≥ 90% for all tests of the proposed hypotheses.
- Ensuring high statistical power increases the credibility of all findings, regardless of whether they are clearly positive, clearly negative or inconclusive.

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

EXPENSIVE TECHNIQUES

Setting a requirement of 90% for statistical power is unrealistic for expensive methods and would require impossibly large sample sizes.

- disadvantages researchers who work with expensive techniques or who have limited resources.

- Underpowered experiments themselves are detrimental to science.
- One solution is to combine resources across research teams to increase power, such as the highly successful IMAGEN fMRI consortium.

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

RESUBMITTING IT TO A HIGHER IMPACT JOURNAL

What is to stop authors with IPA withdrawing their manuscript after getting striking results and resubmitting it to a higher impact journal?

- Nothing! The authors are not locked in a specific journal

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

STUDENT PROJECTS

Much of my research stems from student projects, which operate over too short a time scale to be suitable for Registered Reports.

- This is a legitimate concern
- One way authors can address this is to design and pre-register student projects several months before students commence.
- It is possible to negotiate a delayed commencement date with the editors.

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

PRE-REGISTRATION OF HYPOTHESES AND ANALYSIS PLANS IS TOO ARDUOUS TO BE FEASIBLE FOR AUTHORS.

- The amount of work is similar to conventional manuscript preparation;
- The reward for doing the work in advance, rather than at the end, is that IPA guarantees a publication.

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

HOW ARE REGISTERED REPORTS DIFFERENT FROM CLINICAL TRIAL REGISTRATION?

- Only 1 in 3 peer reviewers of clinical research compare authors' protocols to their final submitted manuscripts.
- Most forms of clinical trial registration (e.g. clinicaltrials.gov) do not peer review study protocols

which provides the opportunity for authors to include sufficient "wiggle room" in the methods or proposed analyses to allow later p-hacking or HARKing.

- Journals that review and publish trial protocols (e.g. Lancet Protocol Reviews, BMC Protocols, Trials), do not provide any guarantee that the final outcome will be published.

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

SLOPPY RESEARCH PRACTICES

If publication is guaranteed in advance, why would researchers bother running their experiments carefully? This scheme could incentivize false negatives arising from sloppy research practices.

- We believe that scientists are motivated to do their work well
- Running a pre-registered study carelessly would also sabotage the outcome-neutral tests, so the result will not be accepted for publication

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

ETHICAL APPROVAL

Stage 1 submissions must have institutional ethical approval to be considered for IPA, and such ethical approval can be highly specific. This means that if a researcher has to change anything about their study design to obtain IPA, the ethics application would need to be amended and resubmitted to the ethics committee. This back-and-forth will be too time-consuming and bureaucratic for many researchers.

- No easy solution.
- An ideal strategy, where possible, is to build in minor procedural flexibility when applying for ethics approval.

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

HOW WILL RRS PREVENT PRE-REGISTRATIONS FOR STUDIES THAT HAVE NO FUNDING OR APPROVALS AND WILL NEVER ACTUALLY HAPPEN?

Stage 1 submissions include a cover letter stating that all necessary support (e.g. funding, facilities) and approvals (e.g. ethics) are already in place and that the researchers could start immediately following IPA.

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4

BURDEN ON REVIEWERS

The peer review process for Registered Reports includes two phases. Won't this create too much additional work for reviewers?

- Note that in conventional review process manuscripts are often rejected sequentially by multiple journals, passing through many reviewers.

Chambers and colleagues (2014)
https://doi.org/10.3934/Neuroscience2014.1.4