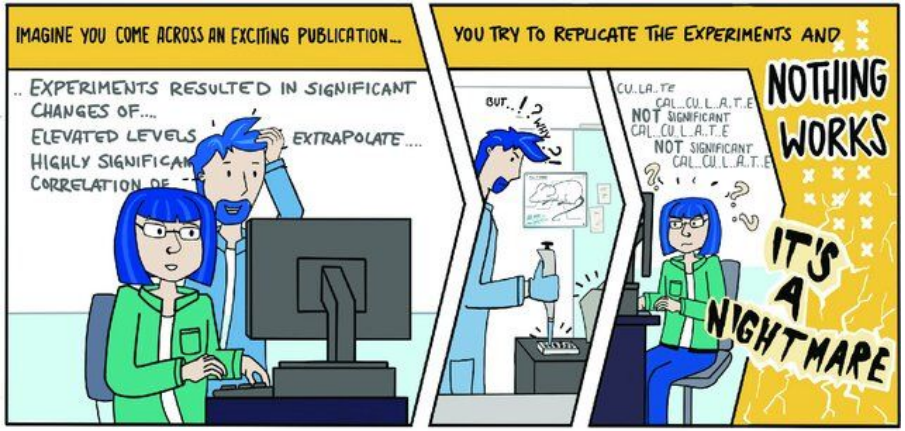

Concepts and tools for protocol documentation and study pre-registration

Cyril Pernet
Robert Oostenveld
Melanie Ganz

What's the idea?

Teacher notes: use some platform for students to share (preferably allow anonymous input for those not feeling comfortable with that - also nothing is mandatory here)

There are always discrepancies between

- Planned experiment and the actual data collection
- The experiment description and the implementation
- The planned analysis and the actual analysis

These create problems, in particular a lack of reproducibility.

Why those discrepancies lead to low reproducibility?
--- 5 min --

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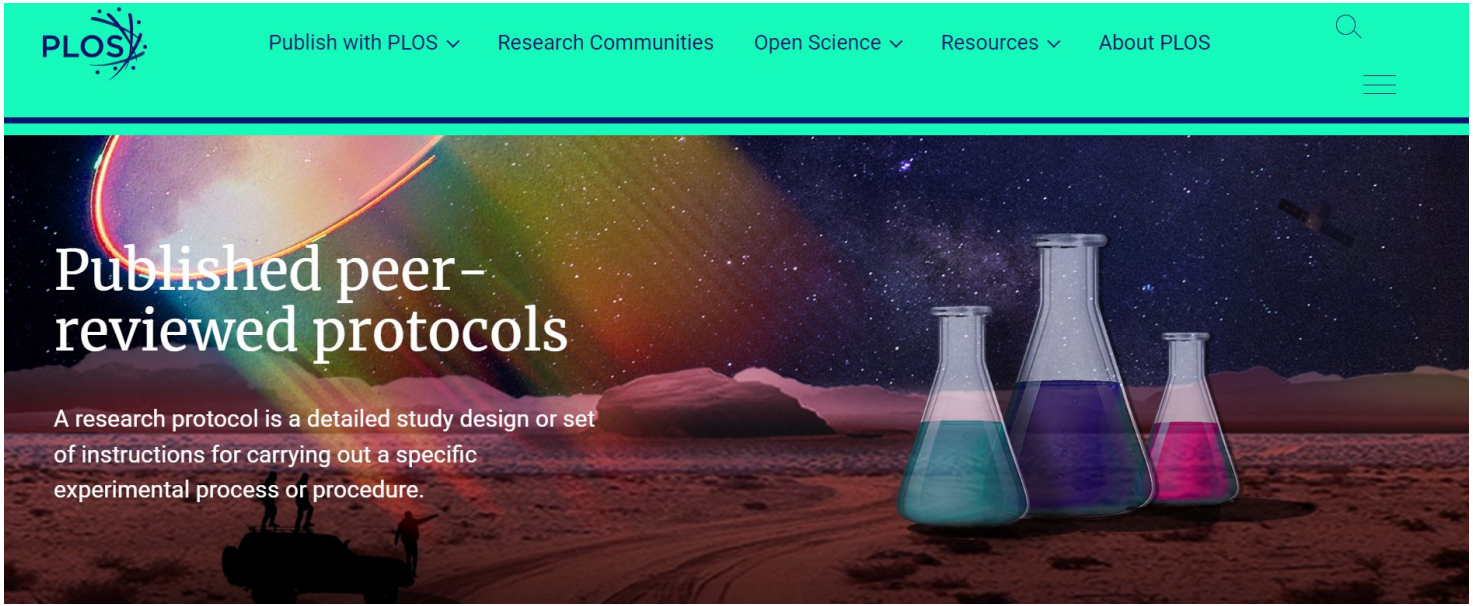

protocols.io

What is documented?

- background, rationale, objective(s), design, methodology, statistical considerations and organization of an experiment
- Step by step instructions

Keeping track of discrepancies

- Good old fashion lab paper notebook!
- Why not add digital log files as notes?
- Electronic lab notebooks → how to choose: https://www.nature.com/articles/d41586-018-05895-3

They are shared between collaborators, they eliminate issues with poor handwriting and damaged paper notebooks and can prevent data from being lost when researchers move on.

Study Pre-registration and Registered Reports

Tell me everything you know about registered report:

- **What is it?**
- **What do the consist?**
- **Any misconceptions?**
- **etc**

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Pia Rotshteins; slide – OHBM 2016

What happens when researchers are pressured to get “good results”?

Pia Rotshteins; slide – OHBM 2016

Publication bias – *suppression of negative or complex findings*

Significance chasing – *“p-hacking”, selective reporting*

HARKing – *hypothesizing after results are known*

Lack of data sharing – *no time, too hard, no incentive*

Low statistical power – *quantity of papers over quality*

Lack of replication – *seen as boring, lacking in intellectual prowess*

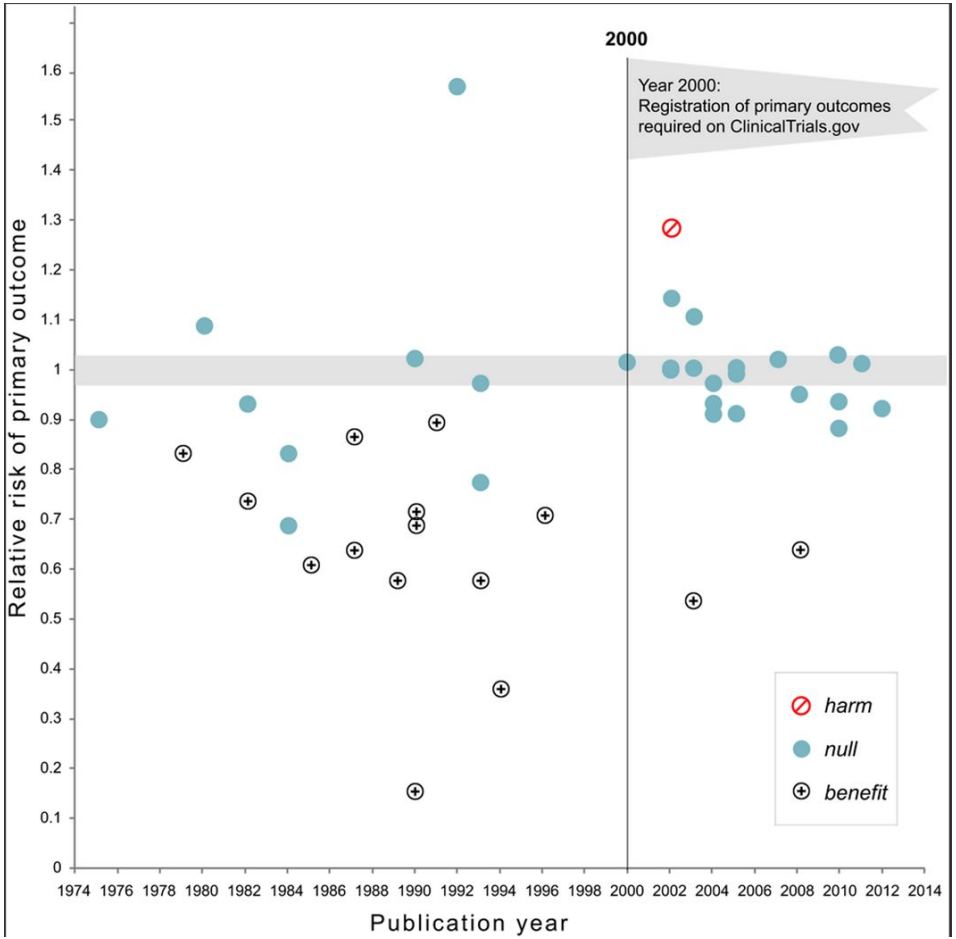
Registered reports

- Similar to protocol papers in clinical trials
- Editorial decision to take your paper before you have results based the QUESTION it asks and the QUALITY of the method it uses (and yes: being before collection, primary outcomes are defined a priori)

  → almost guarantee a publication, no matter the result!

Preregistration of clinical trials causes medicines to stop working!
http://chrisblattman.com/blog/2016/03/01/13719/

Why do you think it 'stopped working'?



Preregistration of clinical trials causes medicines to stop working!
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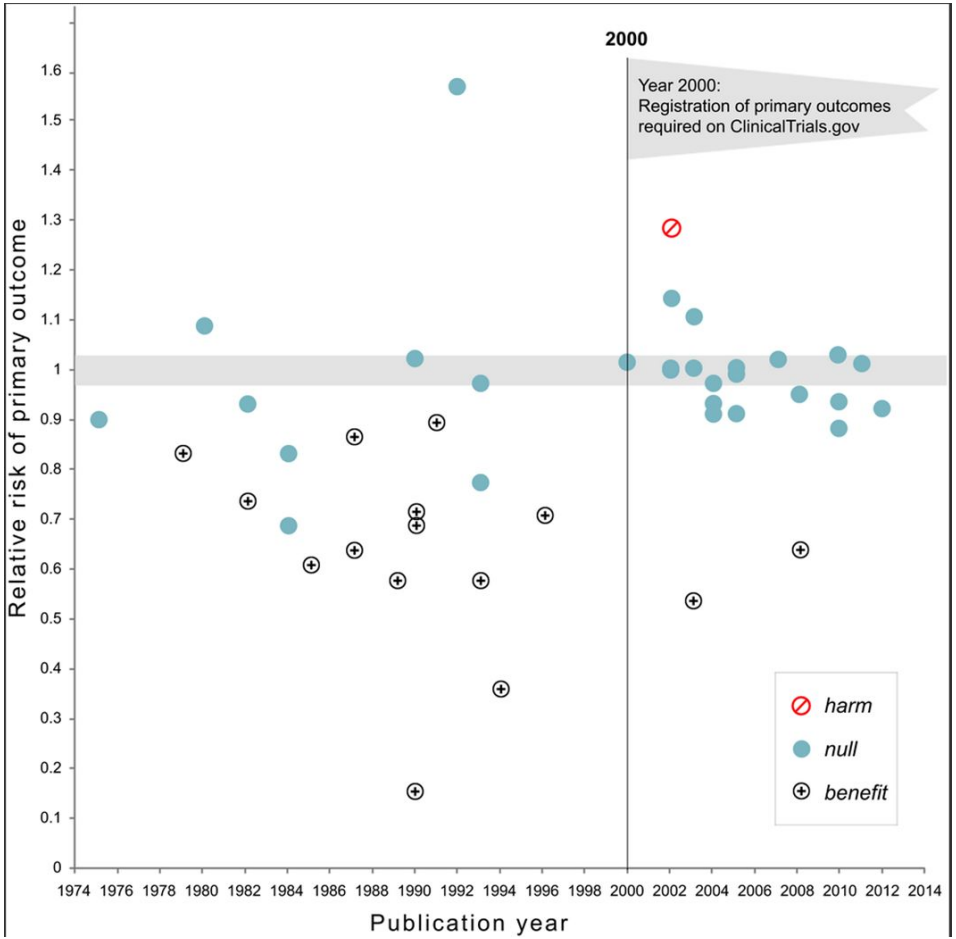
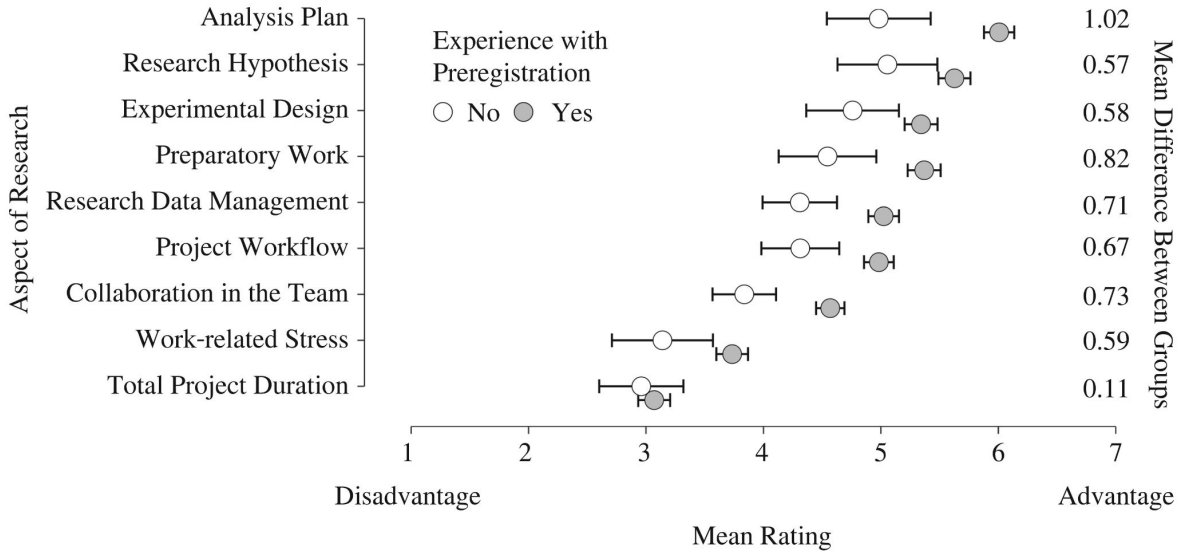
- Publication bias (report negative results)
- Primary outcomes ‘cannot’ be switched



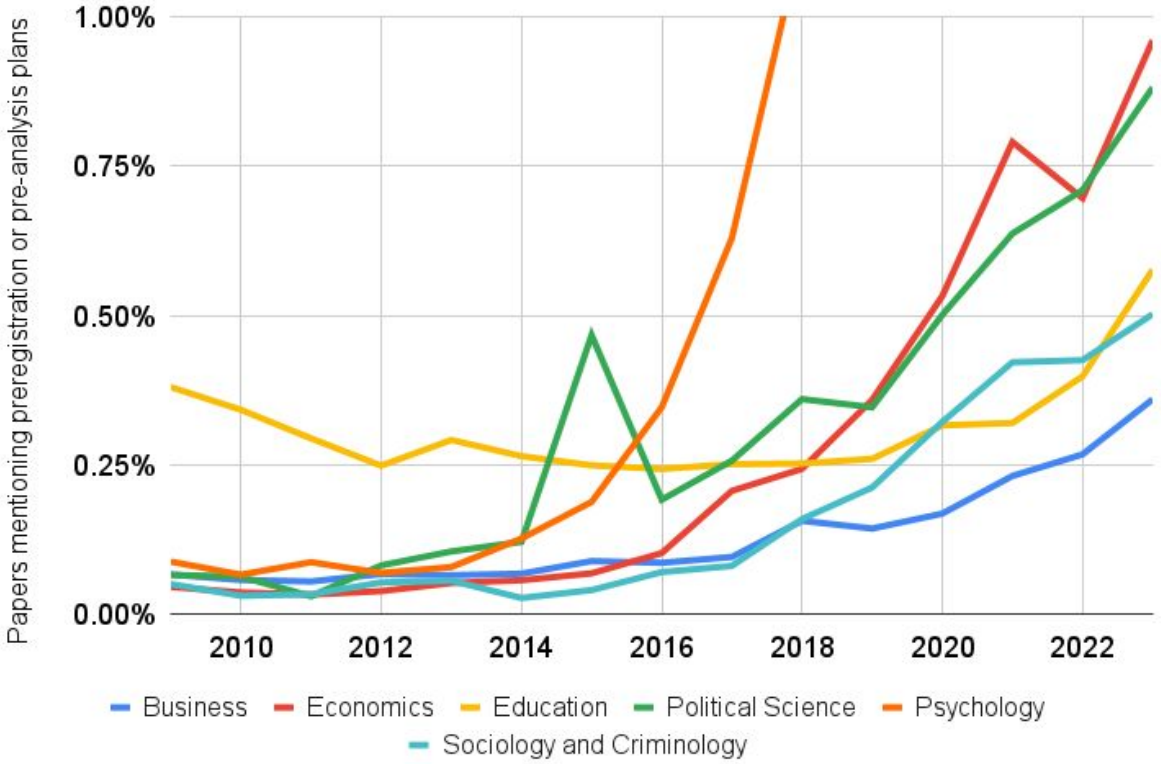
A survey on how preregistration affects the research workflow: better science but more work

Alexandra Sarafoglou† ✉, Marton Kovacs, Bence Bakos, Eric-Jan Wagenmakers and Balazs Aczel

Published: 06 July 2022 https://doi.org/10.1098/rsos.211997



It’s picking up



https://nerdculture.de/@briannosek/110533439789757366

Good for reproducibility

- A study is accepted for publication based on design because
  - 1 – hypotheses are clear,
  - 2 – the method is sound, and
  - 3 – it is well powered
- Why studies are NOT reproducible? Partly because hypotheses aren't clear enough leading to HARKING (hypothesizing after results are known) and because it is not well powered leading to p-hacking (significance chasing by using multiple outcomes and/or methods) which is what pre-registered studies aim at fixing
- It is also good for science by reducing the publication bias, publishing positive and negative results alike, new and replication studies alike.

Good for reproducibility

Declaring statistical procedures before-hand protects from cognitive biases (systematic patterns of deviation from rational judgment)

- ➔ confirmation bias = interpret new evidence as confirmation of one's existing beliefs (if the results don't fit my expectation, there is a problem with data cleaning, or statistical test used)
- ➔ hindsight bias = tendency for people to perceive past events as having been more predictable than they were (if a result appear out of nowhere, we post-rationalize why it happen, maybe re-analyze, reinforcing chances to find get a false positive)