



Concepts and tools for protocol documentation and study pre-registration

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Intended Learning Outcomes

- Explain what is a study pre-registration and why this helps with reproducibility
- Explain what are registered reports

What's the idea?

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 do those discrepancies lead to low reproducibility?

--- 5 min --

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)

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About PLOS

Q =

Published peerreviewed protocols

A research protocol is a detailed study design or set of instructions for carrying out a specific experimental process of procedure.



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:

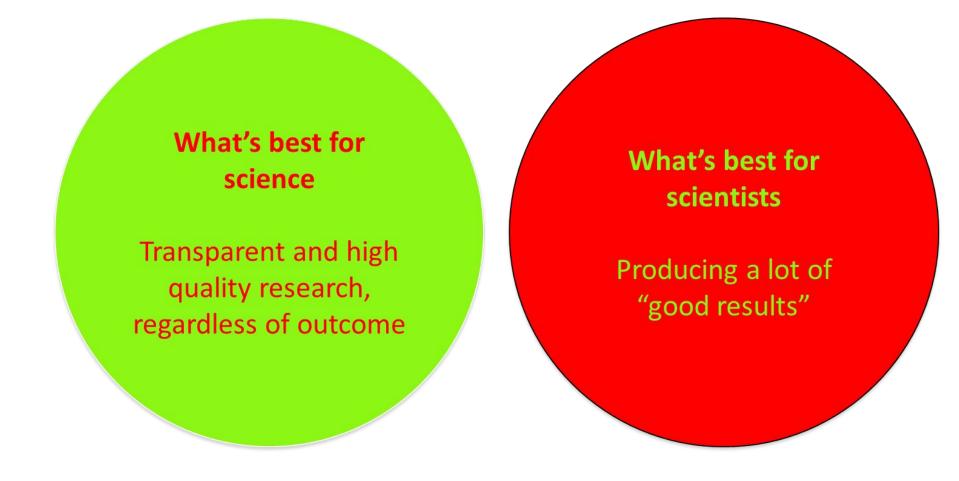
- What is it?
- What do they consist of?
 - Any misconceptions?
 - etc

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Pia Rotshteins; slide – OHBM 2016

What happens when researchers are pressured to get "good results"?



Publication bias – suppression of negative or complex findings

Significance chasing – "p-hacking", selective reporting

HARKing – <u>h</u>ypothesizing <u>a</u>fter 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

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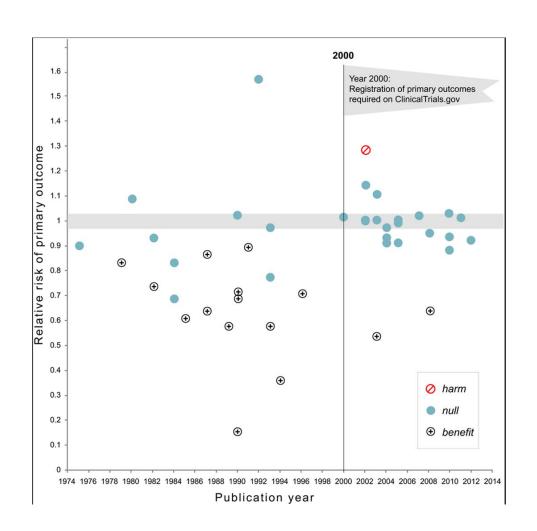
Registered reports

- 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/

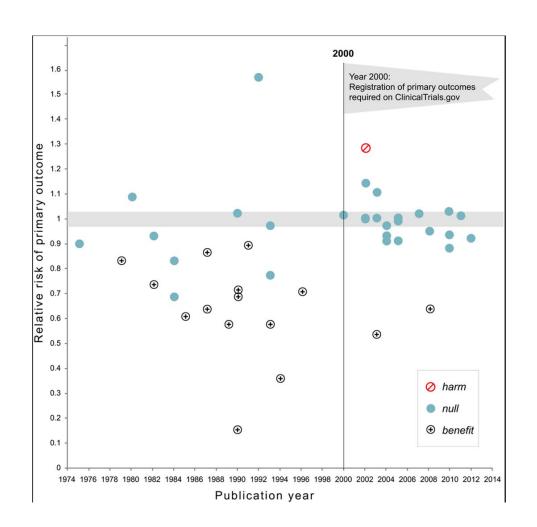
Why do you think it 'stopped working'?



Preregistration of clinical trials causes medicines to stop working!

http://chrisblattman.com/blog/2016/03/01/13719/

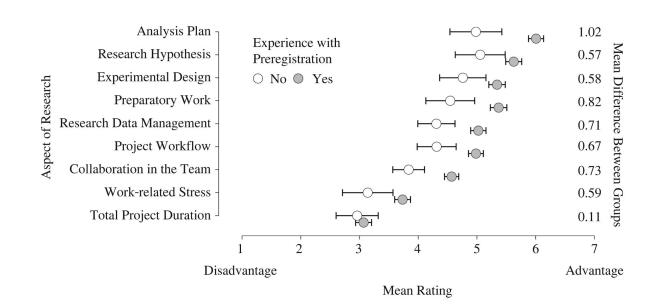
- Publication bias (report negative results)
- Primary outcomes
 'cannot' be switched



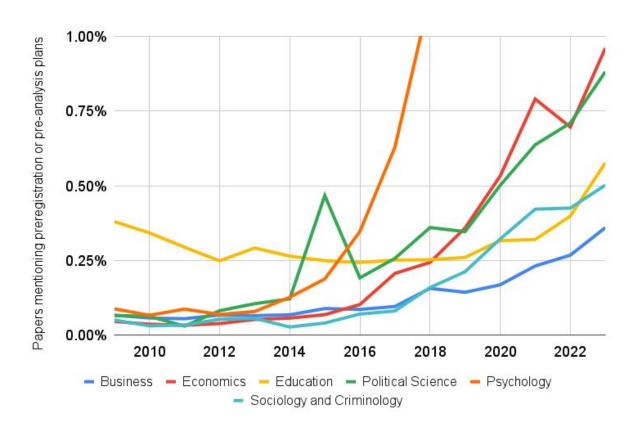
A survey on how preregistration affects the research workflow: better science but more work

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)

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