Reproducibility & the Prevention of Bias: Before, During & After Research

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Disclaimer

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Defining research reproducibility

- Methods reproducibility: *enough detail to be able to repeat it*
- Results reproducibility: *it replicates*
- Inferential reproducibility: *similar conclusions drawn about it*


• But even this still doesn’t cover everything in this debate
“Reproducibility”: a euphemism

- 1958: Kefauver hearings revealed “the sorry state of science supporting drug effectiveness”

- 2012: Begley & Ellis: 6/53 landmark papers in oncology couldn’t be reproduced (Nature 483: 531-533)
Bastian, Glasziou, Chalmers (2010). PLOS Medicine. 7 (9): e1000326. (More recent data added.)
Specialization & complexity has grown

1st co-authored article (1870)

40% of papers have co-authors (1940)

Wikipedia (2001)

1st article with >1,000 authors (2004)

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<tr>
<th>Year</th>
<th>Event</th>
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<tr>
<td>1990s</td>
<td>Greenpeace begins anti-GMO activism.</td>
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<td>50% of the US on the Internet.</td>
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<td>Wakefield links vaccines to autism in The Lancet.</td>
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<td>Climategate email hack.</td>
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<td>Less than half of adults in the US may be sure that vaccines don't cause autism. 5-10% sure they do.</td>
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<td>2000s</td>
<td>World Wide Web</td>
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<td>Facebook</td>
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<td>Twitter</td>
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<td>2010s</td>
<td>hildabastian.net</td>
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Debating science’s problems in 2016: now it’s everybody’s problem

• “The idealized expert-generated, one-way, authoritative reign of science is over.”

THINGS GOT TENSE FOR THE TOWNSFOLK WHEN THE THIRD META-ANALYST GANG RODE INTO TOWN.
- Research on scientific methods – across the full spectrum of activity and use
- Detailed registered protocols for as much research as possible
- Collaborative practice
- Optimizing fidelity
Good data, analysis, and reporting practice
• Communicating results in ways that can be used by non-specialists
The Yin & Yang of post-publication activity

- Valuing quality, replication and validation studies
• Strengthen culture of constructive criticism
• Consequences for authors of non-response to important questions & criticism
• More accountability and consequences for editors, reviewers, and journals  (Südhof (2016). PLOS Biology 14(8): e1002547.)
Skills: design → critical appraisal

- Researchers
- Peer reviewers & editors
- Multidisciplinary colleagues
- Journalists
- Policymakers
- Publics

An ounce of bias prevention is worth a pound of multivariable linear regression.

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Bias prevention beyond research design

- Diversity in participation and areas of study
- Cognitive biases e.g. confirmation bias, motivated reasoning
Cognitive de-biasing

“[We] have made far more progress in cataloguing cognitive biases than in finding ways to correct them.”

WE PROPOSE TARGETING & KNOCKING OUT HUBRIS & REPLACING IT WITH GENEROSITY.

Thanks!