Sign-on letter for scientists on

The appropriate use of scientific evidence for policy

Lead authors

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Signatories listed at the bottom of this letter.

Purpose

We prepared this letter to explain scientists' views of how to use and not use scientific evidence to inform policy.

We write from two perspectives, that of a researcher aiming for the ideal of producing and communicating reliable scientific evidence for public policy. Also, we write from the perspective of non-researchers in the public or decision-making spaces that wish to use scientific evidence consistent with scientific interpretations of that evidence.

Background

Reproducibility is a hallmark of reliable science. Reproducibility depends on qualified researchers being able to independently repeat a discovery by following the same steps.

Reproducibility can potentially make science into the most powerful way of knowing. But first, the original and subsequent findings must withstand independent review and tests of validity. Then, second, a finding must be reproducible in principle and eventually replicated at least once to be considered reliable.

Claims from research findings that cannot be repeated pose a threat to sound decisions. For example, the erroneous conclusions byWakefield and colleagues alleging a causal link between one MMR vaccine and autism in children has left persistent misinformation in media and public discourse despite retraction of the work [1]. The error about one vaccine was generalized to many or all vaccines and amplified and distorted by U.K. newspapers [2]. The particular word choice and signaling varied with the political leanings of the newspapers [2]. If retraction of erroneous findings cannot slow or stop such misinformation and disinformation — campaigns of deliberate spread of inaccurate claims — what can the research and scientific publishing communities do?

The National Academies of Science, Engineering and Medicine, NAS 2017 [3], identified many principles of research integrity to produce reliable, reproducible findings, while also emphasizing how honesty by researchers will be essential to public trust in research findings.

Individuals have added to the NAS 2017 principles [4,5]. Dr. Naomi Oreskes articulated the many reasons to trust science based on the dedication of qualified researchers using the most

[1] Suelzer, E.M., et al., Assessment of Citations of the Retracted Article by Wakefield et al With Fraudulent Claims of an Association Between Vaccination and Autism. JAMA Network Open, 2019. 2(11).
[2] Cosenza, G. and L. Sanna, The Origins of the Alleged Correlation between Vaccines and Autism. A Semiotic Approach. Social Epistemology, 2021. 37(2): p. 150-163.
[3] NAS National Academies of Sciences Engineering & Medicine. Fostering Integrity in Research. Washington, DC: The National Academies Press, 2017.
[4] Oreskes, N., *Why Trust Science?* 2019, Princeton, NJ: Princeton University Press.
[5] Gawande, A., *The Mistrust of Science*, in *New Yorker.* 2016: New York.

transparent and reliable methods to humbly expose their findings to skeptical scrutiny by a diverse community of qualified researchers engaged in open debate without fear or favor [4]. She explains why qualified scientists aiming for the best most reproducible science should be trusted. Dr. Atul Gawande [5] elegantly and concisely summarized the tricks used by pseudo-scientists in campaigns of disinformation. Together these and many other efforts provide the guiding star to conscientious researchers presenting their findings to a polarized and politicized public and associated policy processes.

Here we articulate how researchers should navigate the internal conduct of science to maximize reproducibility and the external conduct of science to improve how our findings are communicated to the public and decision-makers in the science-policy interface. We advocate that only the scientific community — not government bodies or funders — can debate reliability of evidence with honesty and transparency.

Although we may stumble at times and fail to achieve the ideal of reproducibility of our research, we affirm our intent to correct when we stumble. We also affirm our adherence to the following principles.

Principles of reliable, reproducible science

1. Transparency at every step from funding through publication.
2. Use of reliable methods of observation and inference with the scientific method.
3. Uncertainty is always present, the challenge is to reduce it.
4. Independent review of findings helps assure their validity but should be based solely on the methods used.
5. Scientific consensus is elusive but important.
6. All knowledge is provisional but replicated findings or verified predictions that follow the above principles are more reliable than other sorts of evidence.

Principles of communicating our findings

The principles we affirm about the external conduct of science to reach the ideal of fair, accurate communication of our findings follow:

7. Summarize the most important methods and results accurately. Don't overstate results. Clearly state limits to inference and shortcomings of our own findings.
8. Stick to constructive criticism of methods and expect to be criticized by qualified researchers.
9. All our communications about research including peer-reviewed publications are open to use and misuse. It is our own responsibility to prevent or correct our own mistakes and address the misuse of our findings.

Appendix 1 details how each principle above is defined and how it relates to prior and following steps. The Appendix is meant as an evolving guide only and does not necessarily represent the views of all the under-signed. It will evolve as meta-research reveals improvements and as social norms in t he scientific community change over time.

The under-signed believe we can and do recognize when our own science is being distorted for political purposes. Relatedly, we can often recognize when consensus does not exist and when controversy persists among qualified researchers.

Among the signatories below, are a subset who have agreed to list their locations and contact information in case decision-makers wish to consult on specific public policy

issues they face. The views of the lead authors are represented in the Appendix, not necessarily representing the views of the other signatories.

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On the following pages we have included an Appendix that represents the views of the lead authors, not necessarily the signatories.

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