Our survey found 'questionable research practices' by ecologists and biologists – here's what that means

April 10 2018, by Fiona Fidler And Hannah Fraser

Credit: AI-generated image (disclaimer)

Cherry picking or hiding results, excluding data to meet statistical thresholds and presenting unexpected findings as though they were predicted all along – these are just some of the "questionable research practices" implicated in the replication crisis psychology and medicine

have faced over the last half a decade or so.

We recently surveyed more than 800 ecologists and evolutionary biologists and found high rates of many of these practices. We believe this to be first documentation of these behaviours in these fields of science.

Our pre-print results have certain shock value, and their release attracted a lot of attention on social media.

- 64% of surveyed researchers reported they had *at least once* failed to report results because they were not statistically significant (cherry picking)
- 42% had collected more data after inspecting whether results were statistically significant (a form of "p hacking")
- 51% reported an unexpected finding as though it had been hypothesised from the start (known as "HARKing," or Hypothesising After Results are Known).

Although these results are very similar to those that have been found in psychology, reactions suggest that they are surprising – at least to some ecology and evolution researchers.

> the authors report that overall the use of questionable research practices in Ecology and Evolution is about as widespread as in Psychology.
> We've all been watching Psych, wringing our hands over the poor dears but Y'ALL WE'RE IN TROUBLE TOO
>
> — Andrew MacDonald (@polesasunder) March 21, 2018

There are many possible interpretations of our results. We expect there will also be many misconceptions about them and unjustified

extrapolations. We talk though some of these below.

It's fraud!

It's not fraud. Scientific fraud involves fabricating data and carries heavy criminal penalties. The questionable research practices we focus on are by definition questionable: they sit in a grey area between acceptable practices and scientific misconduct.

We did ask one question about fabricating data and the answer to that offered further evidence that it is very rare, consistent with findings from other fields.

Scientists lack integrity and we shouldn't trust them

There are a few reasons why this should not be the take home message of our paper.

First, reactions to our results so far suggest an engaged, mature scientific community, ready to acknowledge and address these problems.

> I'm sadly not surprised by this - when I was "trained" many of these questionable practices were the norm. We need to start training students earlier but also making sure the gate-keepers to grants and publications are educated about these issues too. Enjoy your coffee!
>
> — Matthew Grainger (@Ed_pheasant) March 21, 2018

If anything, this sort of engagement should increase our trust in these scientists and their commitment to research integrity.

Second, the results tell us much more about structured incentives and institutions than they tell us about individuals and their personal integrity.

For example, these results tell us about the institution of scientific publishing, where negative (non statistically significant results) are all but banished from most journals in most fields of science, and where replication studies are virtually never published because of relentless focus on novel, "ground breaking" results.

The survey results tells us about scientific funding, again where "novel" (meaning positive, significant) findings are valued more than careful, cautious procedures and replication. They also tell us about universities, about the hiring and promotion practices within academic science that focus on publication metrics and overvalue quantity at the expense of quality.

So what do they mean, these questionable research practices admitted by the scientists in our survey? We think they're best understood as the inevitable outcome of publication bias, funding protocols and an ever increasing pressure to publish.

We can't base important decisions on current scientific evidence

There's a risk our results will feed into a view that our science is not policy ready. In many areas, such as health and the environment, this could be very damaging, even disastrous.

One reason it's unwarranted is that climate science is a model based science, and there have been many independent replications of these models. Similarly with immunisation trials.

We know that any criticism of scientific practice runs a risk in the context of anti-science sentiment, but such criticism is fundamental to the success of science.

Remaining open to criticism is science's most powerful self-correction mechanism, and ultimately what makes the scientific evidence base trustworthy.

Scientists are human and we need safeguards

This is an interpretation we wholeheartedly endorse. Scientists are human and subject to the same suite of cognitive biases – like confirmation bias – as the rest of us.

As we learn more about cognitive biases and how best to mitigate them in different circumstances, we need to feed this back into the norms of scientific practice.

The same is true of our knowledge about how people function under different incentive structures and conditions. This is the basis of many of the initiatives designed to make science more open and transparent.

The open science movement is about developing initiatives to protect against the influence of cognitive bias, and alter the incentive structures so that research using these questionable research practices stops being rewarded.

Some of these initiatives have been enthusiastically adopted by many scientists and journal editors. For example, many journals now publish analysis code and data along with their articles, and many have signed up to Transparency and Openness Promotion (TOP) guidelines.

Other initiatives offer great promise too. For example, registered report

formats are now offered by some journals, mostly in psychology and medical fields. In a registered report, articles are reviewed on the strength of their underlying premise and approach, before data is collected. This removes the temptation to select only positive results or to apply different standards of rigour to negative results. In short, it thwarts publication bias.

We hope that by drawing attention to the prevalence of questionable research practices, our research will encourage support of these initiatives, and importantly, encourage institutions to support researchers in their own efforts to align their practice with their scientific values.

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