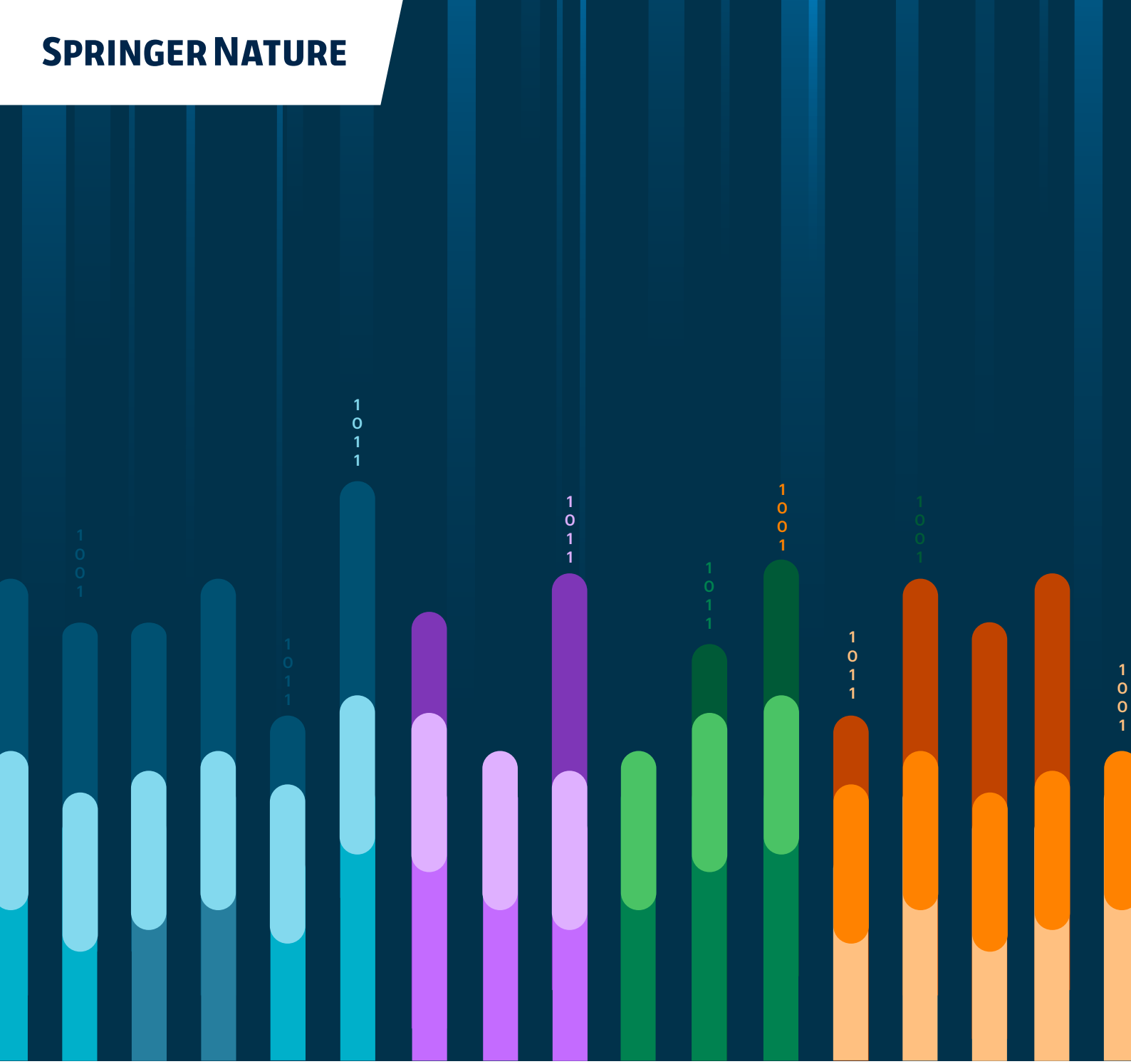
SPRINGER NATURE



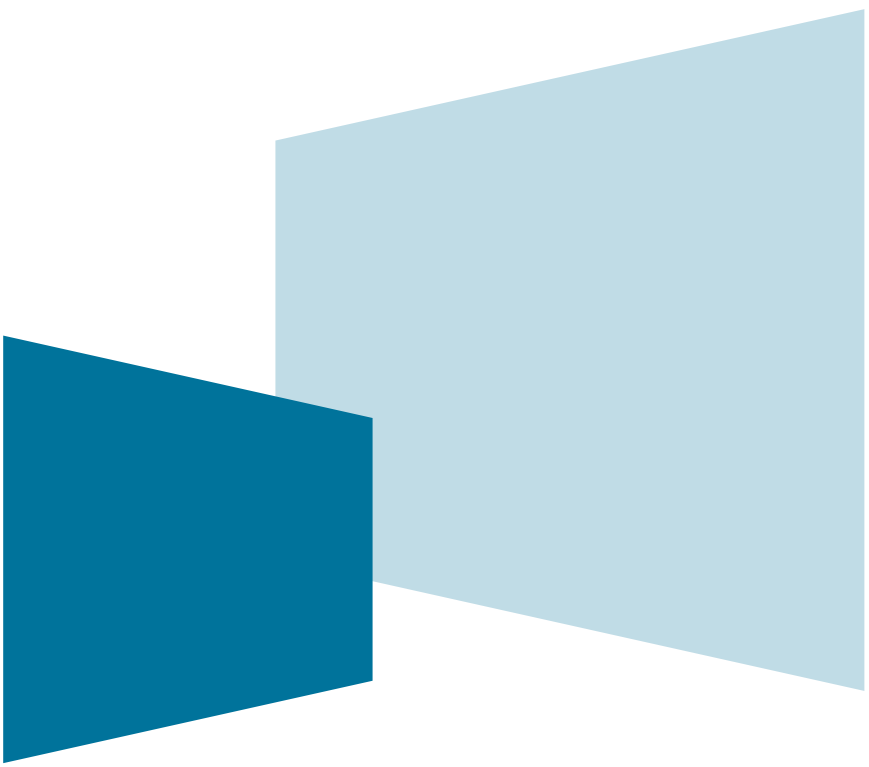
The state of null results

Insights from 11,000 researchers on negative or inconclusive results

White paper

stories.springernature.com/the-state-of-null-results-white-paper

Table of contents



Foreword

As a publisher, Springer Nature is committed to truly serving the advancement of knowledge by communicating all categories of research with scientific rigour. This is achieved by employing robust research integrity practices, and recognising that all validated research, regardless of the outcome, plays a crucial role in advancing learning and the pace of innovation.

Researchers need access to both 'positive' and 'negative' results to fully understand a research topic. Yet the scientific community appears to have created a research environment where researchers either feel little point in writing up null results and/or struggle to publish such findings. This means that, due to a lack of awareness, many researchers are wasting time, effort, and funding by duplicating research that is later proven to be negative as well as not sharing data that may challenge published findings. An assumption is also being made that these results hold little value. But surely if only one researcher is inspired, and the negative finding contributes to a new scientific discovery, then that value should be recognised?

Springer Nature is dedicated to communicating all forms of research and we publish a range of inclusive journals that aim to publish all in-scope, technically sound research that has undergone rigorous peer review and validation. These journals provide a platform for null results, foundational and fundamental advances, as well as more descriptive papers on experimental design and data studies which support reproducibility and data sharing.

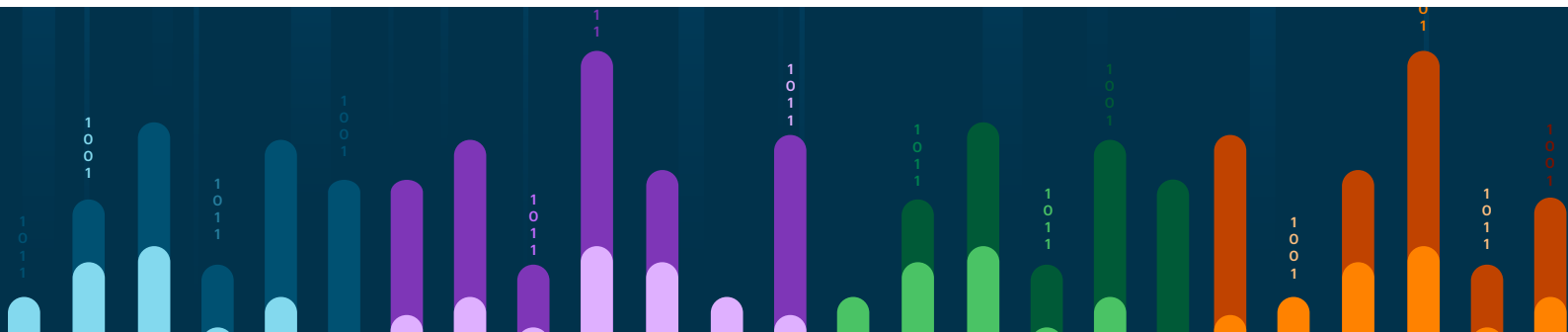
We wanted to better understand why negative results are not regularly being reported. *The state of null results* white paper, based on survey responses from over 11,000 researchers, presents insights into researchers' attitudes towards, and experiences with, sharing null results. 98% of researchers recognise the value of shared negative results and yet so few null results papers are published.

A key insight from the survey data underscores the urgent need to reform current research assessment practices. Thirty years ago, the research landscape was more regionally focused, with fewer and predominantly western researchers, who had a greater awareness of others in their field, and who could share knowledge such as null results through personal communication. Today, we have a research landscape that is around three times larger, with roughly forty percent of research contributed by researchers from western nations and around forty percent from Asia. To share research globally, it needs to be validated and published.

The traditional research practice of writing papers, focusing on citing incremental positive advances, also means null papers are not cited. Encouraging new mechanisms that recognise and reward the sharing of null results could help address this imbalance. We hope that all stakeholders across the research ecosystem will work towards addressing researchers' needs and better supporting the publication of null results.

Ritu Dhand

Chief Scientific Officer
Springer Nature



Executive summary

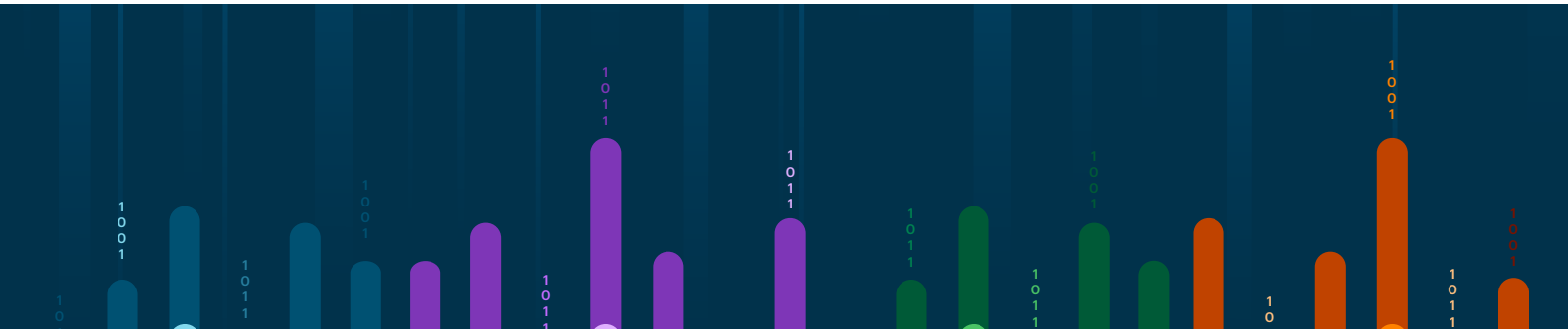
Null results—research findings that do not support a tested hypothesis—are a vital yet underrepresented part of the scientific record. Despite their potential to reduce research waste, improve transparency, and inspire new lines of inquiry, they remain significantly underreported in scholarly literature. To gain deeper insights into current attitudes and behaviours amongst the researcher community, Springer Nature conducted one of the largest global surveys of its kind to date. This white paper presents findings from over 11,000 researchers across 166 countries and all major disciplines.

Key findings

- Null results are prevalent and valued: Over half (53%) of researchers have generated null results, and an overwhelming majority (98%) recognise their value (n=11,069).
- Publishing null results yields tangible benefits: The top three benefits experienced by those who have published null results in a journal (n=1,228) included:

  - **Inspiring a new hypothesis or methodology in relation to the research topic (39%)**
  - **Helping identify issues with the methodology (29%)**
  - **Preventing the duplication of unnecessary research (28%)**

- There is a gap between intent and action: Whilst 85% believe that sharing null results is important (n=11,069), only 68% of those who have generated null results have shared them in some form, with less than a third (30%) having submitted them to a journal (n=7,057).
- Perceived barriers to publishing null results concern potential authors: Researchers cite several challenges, including concerns about negative bias leading to reputational harm, a lack of clarity on where to publish, a low likelihood of journal acceptance, and a lack of support. Only 15% are aware of journals that actively encourage null result submissions (n=11,069).
- Experiences of publishing null results were mostly positive, but risks remain: Amongst those who had published null results in journals (n=1,228), 72% reported positive outcomes, including methodological improvements and new collaborations. However, 20% experienced negative consequences, such as damage to career prospects.



- Support and incentives are limited, but seem impactful: More than half (55%, n=11,069) of researchers are unaware of institutional or funder support to share null results, and current research assessment systems rarely reward the publication of null results. However, where researchers are aware of support, there are higher rates of sharing, indicating a correlation between the two.

Recommendations

To close the gap between intention and action, there are some key areas that we as an academic community can address:

- Increase visibility and support: Journals, institutions, and funders should clearly communicate policies and provide resources for publishing null results
- Promote cultural change: Educational campaigns and success stories can normalise the sharing of null results, reduce stigma, and showcase the benefits of publishing
- Reform research assessment: Broaden evaluation criteria so that all rigorous research, regardless of outcome, is recognised in research assessment

Introduction

Null results, also known as 'negative results' or 'inconclusive results' are outcomes that do not confirm the hypothesis of a research project. Sharing null results is essential for robust science and can:

- Inform other researchers that the original line of research did not support the hypothesis
- Prevent the duplication of unnecessary research, saving time and funding
- Inspire new hypotheses or methodologies in relation to the research topic
- Increase transparency and reproducibility in research[1]
- Accelerate the advancement of scientific discoveries

Yet the value of sharing null results is often not fully understood. The issue of research waste is significant. A study prepared for the European Commission estimated in 2018 that up to €26 billion in Europe alone has been wasted due to duplicated work stemming from a lack of awareness, or access to, existing research data or null results.[2] Another study showed that the National Institutes of Health is costing US taxpayers over $100 million per year due to research waste through unreported trials.[3,4]

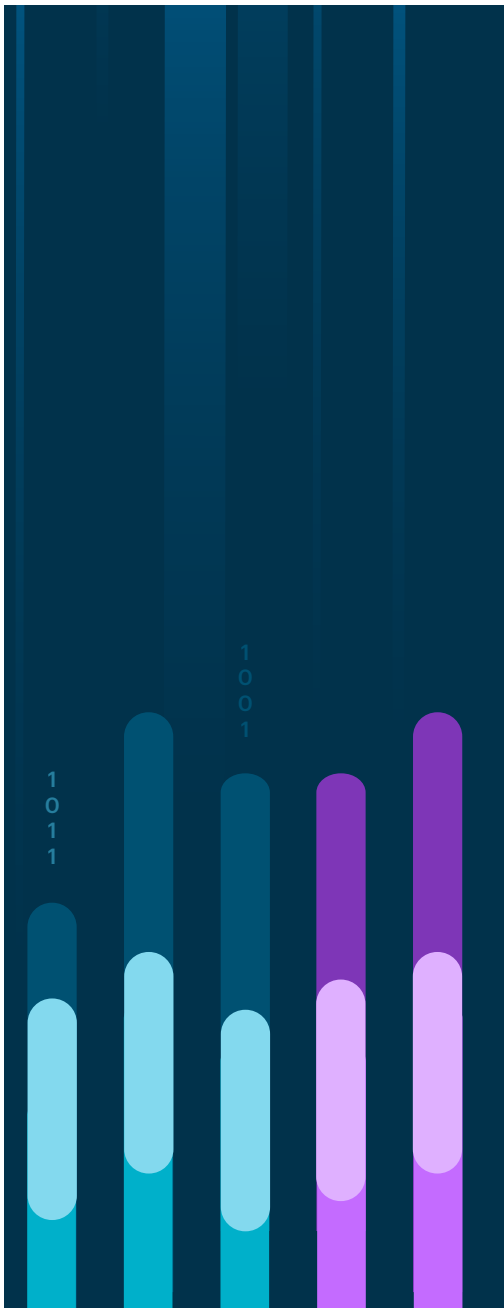
Whilst publishing null results in peer-reviewed journals is considered the gold standard, compared with sharing null results directly with other researchers or at conferences, the proportion being published is in decline.[5,6] Previous small-scale surveys on this topic have explored barriers to sharing null results. One of the major barriers identified was due to the limitations of traditional research assessment. Where metrics such as citations and the Journal Impact Factor form the basis of evaluations, there is limited positive recognition for publishing and citing null results which attract fewer citations. By including other types of metrics in assessment, outputs would be recognised.[7]

There also continues to be a stigma attached to reporting null results, despite it being a common outcome and part of the research process. Other challenges include not knowing where to publish null results, and a lack of time or motivation to do so.[8]

To better understand researchers' perceptions and attitudes to null results, their behaviours and experiences in sharing them, and the challenges they face in publishing them, we surveyed 11,069 researchers in 2024. This white paper presents the findings from that survey, one of the largest of its kind, with responses from 166 countries across disciplines, regions and levels of researcher seniority. By exploring these topics, we aim to share evidence-based recommendations that can help us, as an academic community, better address and support the value of null results.

Terminology

As there are different ways to describe an outcome that does not confirm the desired hypothesis, we used 'null results' as the singular term throughout the survey, avoiding potential negative connotations of the term 'negative results',[9] and the definition was shared upfront in the survey (see Appendix A.1).



References

[1] Baker, M. (2016). 1,500 scientists lift the lid on reproducibility. *Nature 533*, 452–454. https://doi.org/10.1038/533452a

[2] European Commission. (2018). *Cost of not having FAIR research data: Cost-benefit analysis for FAIR research data* (p. 26). https://doi.org/10.2777/02999

[3] Bruckner, T. (2023). *NIH waste far over $100 million in medical research funding every year – new study*. https://www.transparimed.org/single-post/nih-research-waste.

[4] Rees, C. A., Narang, C., Westbrook, A., & Bourgeois, F. T. (2023). Dissemination of the results of pediatric clinical trials funded by the US National Institutes of Health. *JAMA*, *329*(7), 590–592. https://doi.org/10.1001/jama.2022.24025

[5] Bespalov, A., Steckler, T., & Skolnick, P. (2019). Be positive about negatives – recommendations for the publication of negative (or null) results, *European Neuropsychopharmacology, 29* (12), 1312–1320. https://www.sciencedirect.com/science/article/pii/S0924977X19317195

[6] Brazil, R. (2024). Illuminating 'the ugly side of science': fresh incentives for reporting negative results. *Nature*. https://www.nature.com/articles/d41586-024-01389-7

[7] Echevarría, L., Malerba, A., & Arechavala-Gomeza, V. (2021). Researcher's perceptions on publishing "negative" results and open access. *Nucleic Acid Therapeutics, 31*(3), 185–189. https://doi.org/10.1089/nat.2020.0865

[8] Herbet, M.E., Leonard, J., Grazia Santangelo, M., & Albaret, L. (2022). Dissimulate or disseminate? A survey on the fate of negative results. *Learned Publishing, 35*(1), 16-29. https://doi.org/10.1002/leap.1438

[9] Herbet, M.E., Leonard, J., Grazia Santangelo, M., & Albaret, L. (2022). Dissimulate or disseminate? A survey on the fate of negative results. *Learned Publishing, 35*(1), 16-29. https://doi.org/10.1002/leap.1438

Main findings

The benefits of sharing null results

This section explores positive attitudes towards sharing null results as well as any benefits that researchers have experienced after sharing null results.

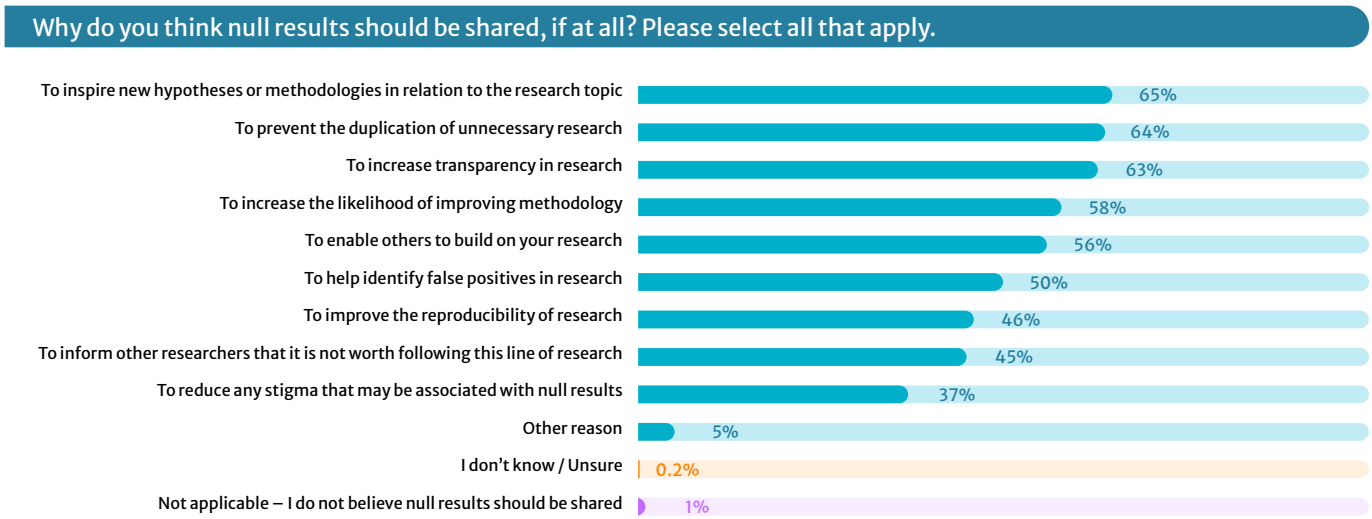
Challenges in sharing and publishing results are explored in Section 3.

Most researchers (85%) say that it is 'somewhat' or 'very important' to share null results – although there could be a self-selection bias considering the topic of the survey that they chose to participate in (n=11,069).

1.1 Perceived benefits

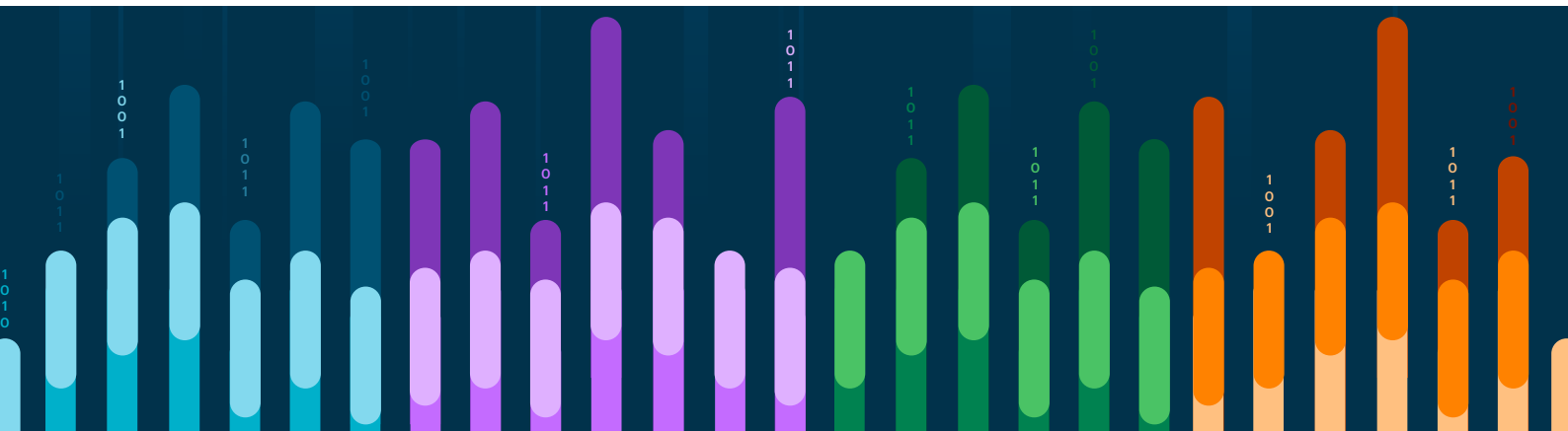
98% of researchers recognise the benefits of sharing null results, with almost two thirds thinking that null results can inspire new hypotheses or methodologies; prevent the duplication of unnecessary research; and/or increase transparency in research. Over half think that sharing null results increases the likelihood of improving methodology and/or enables others to build on research.

Figure 1: Researchers' perception of benefits in sharing null results



Sample: All responses (n=11,069); Unweighted.

When asked to what extent they agreed that 'sharing null results improves the quality of subsequent research,' 88% agreed (n=11,069).



1.2 Experienced benefits

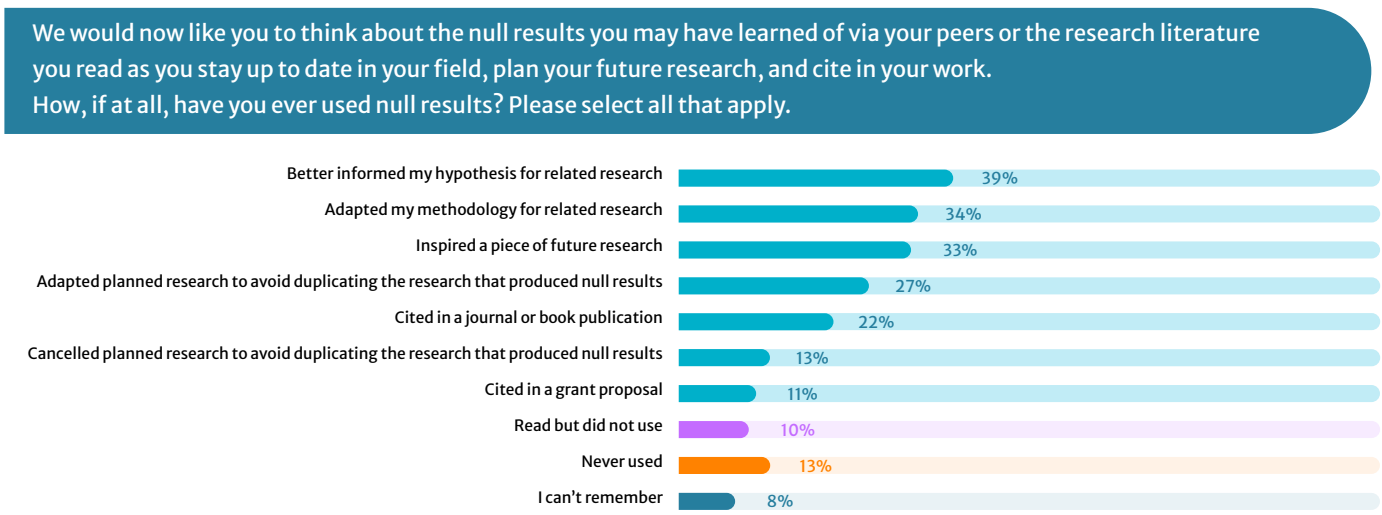
Researchers were asked about their experiences both as readers and as authors to understand the impact of sharing null results on researchers in their different roles throughout the research lifecycle.

1.2.1 Benefits experienced as a reader

68% recall utilising null results shared by others, with the top three benefits being: sharing null results better informed their hypothesis, led to them adapting their methodology, and/or inspired a piece of future research (n=11,069).

> *"When I came across research that produced null results, I adapted my planned methodology to avoid redundant work and potential failure. This helped me refine my hypothesis and identify alternative approaches before proceeding with an experiment, ultimately saving time and resources. Furthermore, these null results inspired me to reframe my understanding of the research question and sometimes shift my focus toward more promising avenues or theories."*
>
> **– Indonesia, Social Sciences, Technician/Research Assistant at a University/College**

Figure 2: Benefits of reading or using null results shared by others



Sample: All responses (n=11,069); Unweighted.

Respondents commented on the topic of how sharing null results can reduce research waste and duplication, for example:

> *"I was told a widely used methodology did not show what it was supposed to. Also, that antibodies from several major companies were poor and next to useless. But I only ever saw that information in 2 journal articles (briefly mentioned, years later) buried among other information in the articles. Had I known beforehand if it had been widely disseminated in my field, it would have saved me 2+ critical research years!"*
>
> **– USA, Medicine, Associate Professor at a University/College**

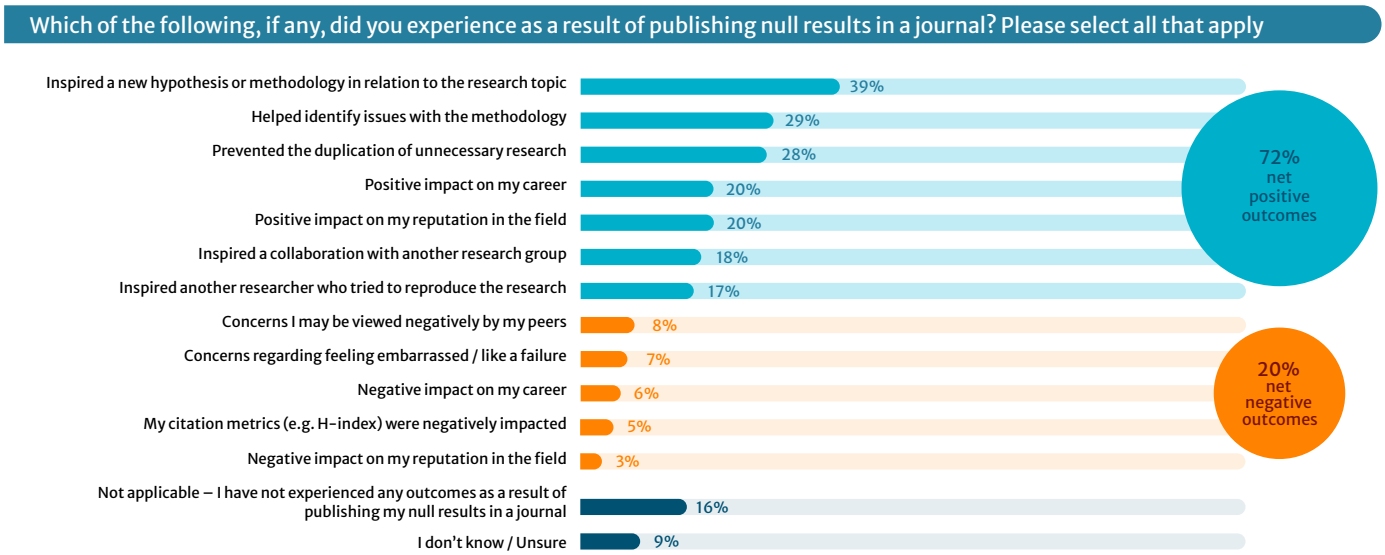
1.2.2 Benefits to authors publishing null results in a journal

The survey made a distinction between *sharing* null results by any channel (see Section 2.3), and *publishing* null results in a journal, to understand whether journal publication had played any role in benefits experienced by authors.

From respondents who have submitted a manuscript based (solely or mostly) on null results to a journal, and whose most recent manuscript based on null results was accepted for publication (n=1,228), 72% reported a positive outcome from publishing null results in a journal. However, 20% shared concerns which were mostly about negative impacts on their reputation or career. Additionally, 16% responded that they have not experienced any outcomes as a result of publishing null results in a journal.

The top three positive experiences included: inspiring a new hypothesis or methodology in relation to the research topic (39%), help identifying issues with the methodology (29%), preventing the duplication of unnecessary research (28%).

Figure 3: Experiences of publishing null results in a journal



Sample: All responses from population who have "Submitted a manuscript based (solely or mostly) on null results to a journal" and most recent manuscript was accepted for publication (n=1,228); Unweighted.

Looking at examples of these top three positive experiences for authors, publishing null results in a journal has:

Successfully challenged prior theory and changed the status quo in their field

"Since we published the article that has negative results, other researchers have cited the article. People are happy and it has changed the false information held for many decades. Note that the publication has some impact but very helpful for those in community medicine. During this period, we have been able to sensitize women in the rural areas [...]. That's one of importance of null result."

– Nigeria, Medicine, PhD or Master's Student at a University/College

"By sharing the null results informally with the journal, we found other groups with similar results (and who had previously been rejected) and collaborated with them to submit three back-to-back papers. Now, this forms the mainstream of research in this particular area. So, in fact, the publication transformed null results into positive results."

– Canada, Biology, Research Scientist at a Research Institute

Inspired a new or refined methodology, hypothesis, or line of research

"Publishing a null result has helped other groups adjust their hypothesis and experimental approach, and the community has advanced more as a consequence."
–United Kingdom, Biology, Professor in a University/College

"My results were not in line with those of my peers. Indeed, they opened a new research field."
– Italy, Biology, Principal Investigator at a Research Institute

Limited research waste by preventing the duplication of unnecessary research

"The negative results paper we published was widely cited and revealed that others had in fact tried our type of experimentation and generated negative results as well. This allowed them to cite our publication to prevent others from spending time on unproductive methodologies."
– Switzerland, Biology, Postdoc in a University/College

"Someone reached out to me telling it was good we published the study, because they had planned a similar study but cancelled it due to our null result."
– Finland, Engineering, Research Scientist in a University/College

Further positive responses indicated impacting their career (20%) and on their reputation in the field (20%). 18% said that publishing null results inspired a collaboration with another research group, and 17% said that it inspired another researcher who tried to reproduce the research.

Examples taken from the free-text comments show that publishing null results has:

Led to collaborations or networking opportunities

"Our null results paper provided evidence against one of two competing hypotheses for why a species is declining. It helped my career and helped the USFWS make better management decisions about the species. It also fostered new collaborations with international colleagues."
– United States, Earth and Environmental Science, Research Scientist at a Government Institute or Agency

"The lack of a definitive result changed our methodology and facilitated a collaboration with another group to further explore alternatives"
– Australia, Earth and Environmental Science, Laboratory Director/Head at a Government Institute or Agency

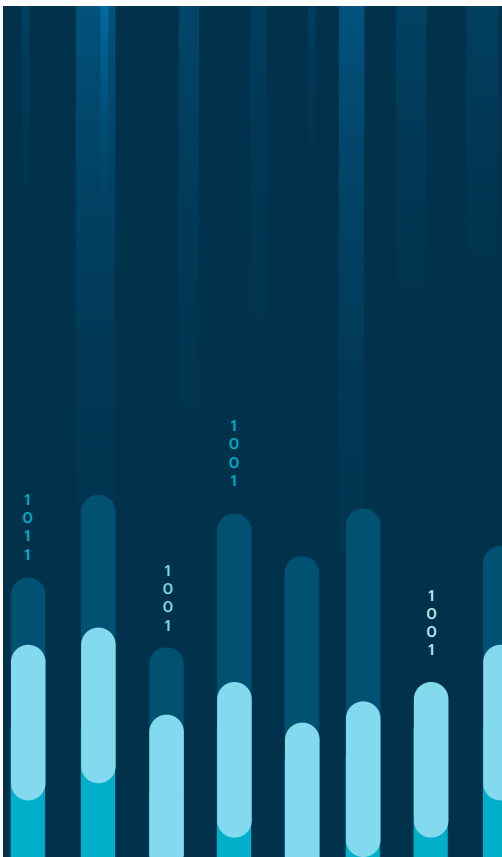
Strengthened their reputation as a trustworthy researcher who acts with integrity and transparency, or as a pioneer in their field

"The most prominent case where I published null results, I was presenting data that showed that an area of research in coal desulfurization was only being pursued because of false positive results. After this was published, research in that particular area essentially ceased. As a result, while this paper was widely read, it was not cited to any great extent because there were no papers being published to cite it. On the other hand, it did enhance my reputation as a careful, trustworthy researcher."
– United States, Materials Science, Associate Professor at a University/College

Had a positive impact on career progression

"My published manuscript of 'null' results including discussion of potential reasons for null results and implications for future research, was selected for a national award as "best published manuscript" for the year (ADHD study) by the peer reviewed journal that published study results."
– United States, Medicine, Principal Investigator at a Medical school/ Hospital/Clinic

"[...] It also helped me secure a PhD position."
– Norway, Biology, PhD or Master's Student at a University/College



Current practices in sharing null results

Following on from the positive perceptions and experiences around the use and sharing of null results highlighted in Section 1, this section will explore the current practices of sharing these findings, by addressing the following questions:

- How common are null results?
- Are null results being shared?
- How are null results being shared?

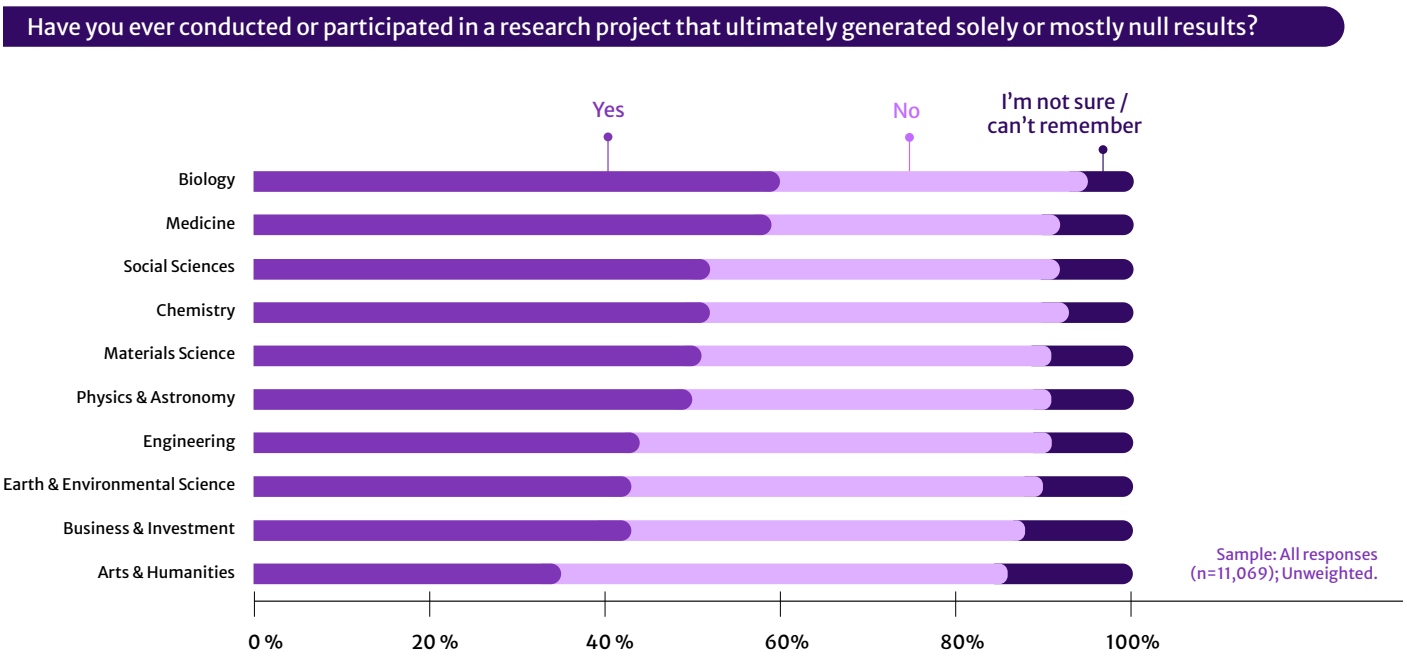
2.1 How common are null results?

Over half (53%) of researchers have obtained null results in a project that generated solely or mostly null results. 41% of all researchers generated null results from at least one research project in the last three years, including 1% with more than ten projects obtaining null results in the last three years (n=11,069).

39% had not conducted or participated in a research project that generated solely or mostly null results, and 8% were unsure.

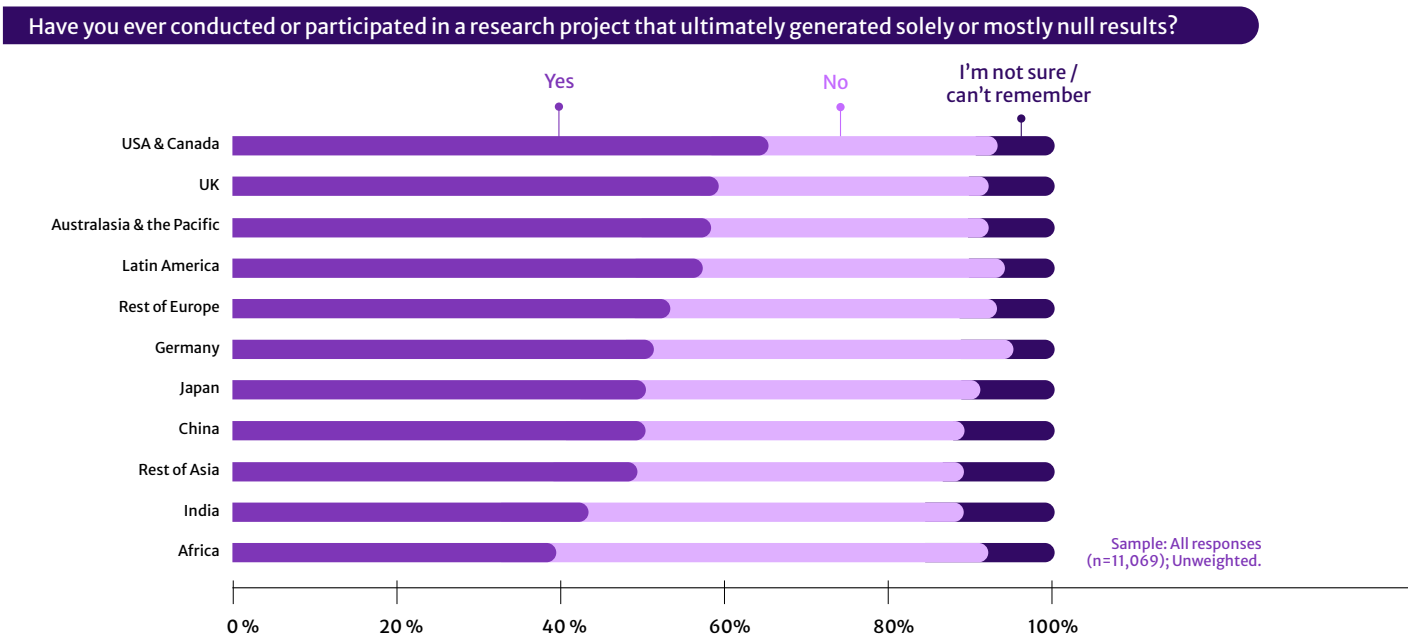
Looking at responses by discipline, researchers in Biology and Medicine are the most likely to have generated null results, at 60% and 59% respectively. The prevalence for obtaining null results is lowest within the Arts & Humanities (35%), followed by Business and Investment and Earth & Environmental Science (both at 43%), and Engineering (44%).

Figure 4: Prevalence of null results across different fields



Interestingly, there was more of a discrepancy when examining responses by region. USA and Canada gave the highest positive response of generating null results (65%), with the lowest being Africa at 39% and India at 43%. Further research could be undertaken to examine these regional differences.

Figure 5: Prevalence of null results across different regions



2.2 Are null results being shared?

Despite over half of researchers obtaining null results, they are not always being shared, with only 68% of those who have collected null results sharing them (n=7,057). 25% stated that they had never shared, or tried to share, null results generated in their research, and 6% could not remember whether they had shared them.

Even among researchers who consider sharing null results very important, and who collected mostly/solely null results themselves (n=3,989), only 74% have shared them, indicating a gap between intention and action.

Null results sharing behaviour varies by subject area, with researchers from the Social Sciences (75%), Medicine (73%) and Arts and Humanities (72%) having shared their null results previously. Engineering and Materials Science are least likely to share, with 36% having never shared or tried to share null results generated in their research.

Regionally, researchers from Australasia and the Pacific are the most likely to share (79%), followed by the UK (75%) and North America (74%). Researchers in China are the least likely to share, with 35% of respondents never having shared, or tried to share, null results generated in their research.

There is a smaller variation by researcher seniority (based on job title), where 75% of senior career researchers, 69% of mid-career researchers, and 59% of early career researchers have shared or tried to share null results. This could be explained by senior researchers having generated more cases of null results, giving them more opportunities to have shared them, compared to less senior researchers.

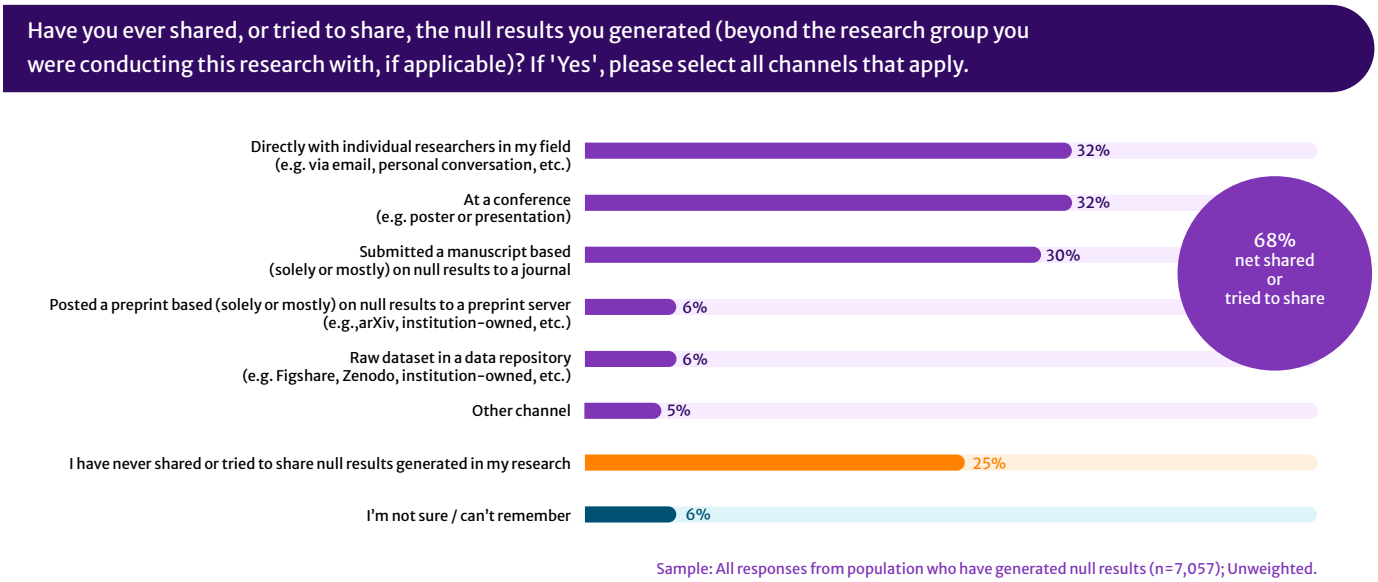
2.3 How are null results being shared?

The three most popular methods of sharing null results are:

- Directly with individual researchers in their field e.g. email, personal conversation (32%)
- At a conference eg poster or presentation (32%)
- Submitting a manuscript based (solely or mostly) on null results to a journal (30%).

Other methods included posting a preprint to a server (6%), uploading the raw dataset to a data repository (6%), or another channel (5%) – such as including them as part of a larger study or book "so that all of the results were not null".

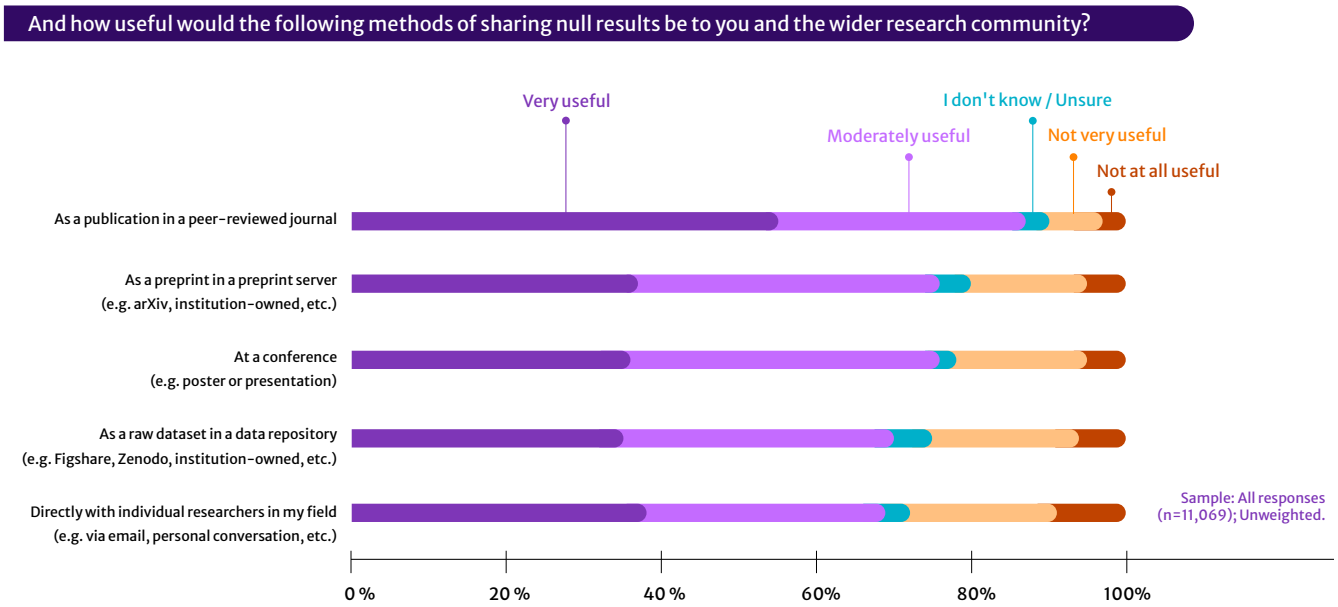
Figure 6: The different channels researchers have used to share null results



However, the gap between intention and action continues when we examine how researchers are sharing null results compared to their view of the usefulness of each channel. The most useful method of sharing null results was via publication in a peer-reviewed journal: 87% of respondents think that is a 'very useful' or 'moderately useful' method of sharing. However, only a minority of those respondents (33%) had shared their own null results via this method.

Direct sharing with individuals was considered the least useful method, although with an agreement rate of 69% about its usefulness, this is still high. From those who had rated direct sharing as 'very useful' or 'moderately useful', only 37% had in practice shared null results via this route.

Figure 7: Researchers' perception of how useful various channels are when sharing null results



Challenges in publishing null results in a journal

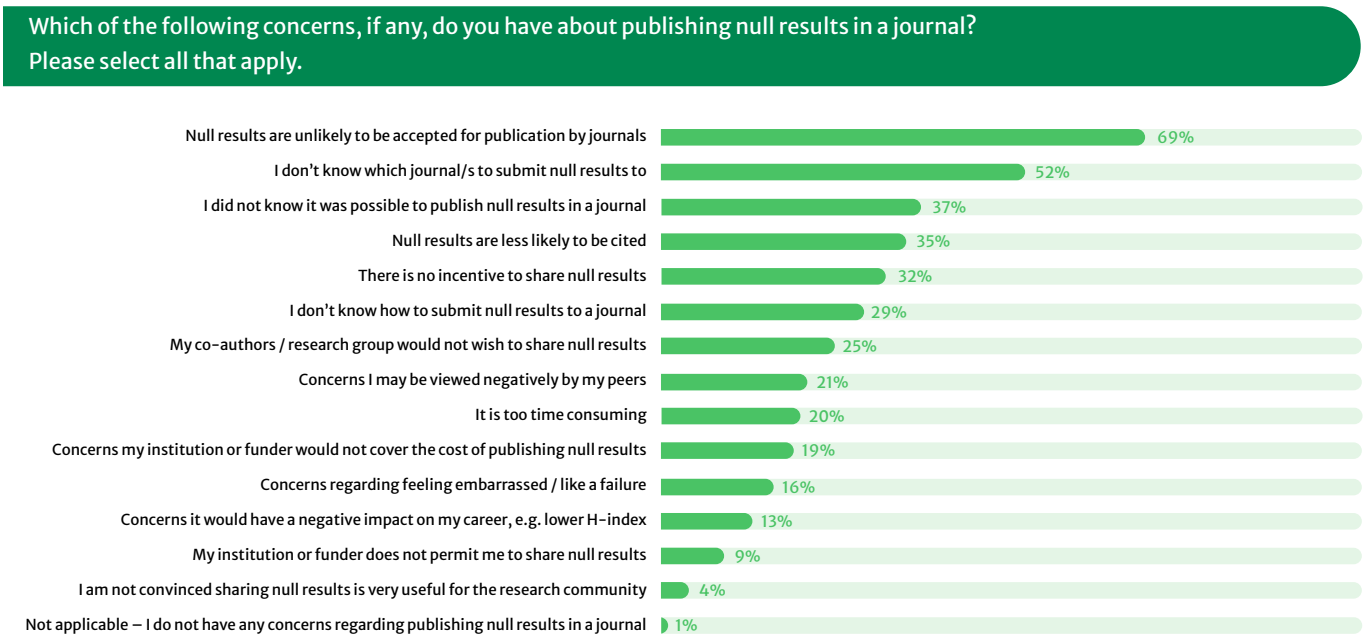
Despite strong support among researchers for sharing null results as outlined in Section 1, many still hesitate to do so—especially through journal publication, as seen in Section 2. What is preventing them from doing so?

This section explores the key barriers to publishing null results, including researchers' perceived concerns as well as negative experiences they have encountered—either during the submission process or as a consequence of publication.

3.1 What are the barriers to publishing null results in a journal?

From those who have generated null results and agree they are important to share, but have not yet shared or tried to share them (n=1,489), the top two concerns about publishing null results in a journal were: 'null results are unlikely to be accepted for publication by journals' (69%), and 'I don't know which journal/s to submit null results to' (52%).

Figure 8: Concerns about publishing null results in a journal, from those who have generated null results and agree they are important to share, but have not yet tried to.



Sample: All responses from population who have generated null results, but not shared or tried to share them, and think sharing null results is "very" or "somewhat important" (n=1,489); Unweighted.

3.1.1 Perceived bias and reputational risk

Perceived biases can present in different ways. For example, survey respondents reported a negative connotation to using the term 'negative results'.

More about the different terms used to describe 'null results' by survey respondents can be found in Appendix 1.

There were also numerous fears that publishing null results would have a negative impact on their career and/or reputation. These concerns align with previous findings that best practices and research assessment's reliance on quantitative metrics, such as citations and Journal Impact Factors, do not incentivise the publication of null results.[10]

On a more personal level, 21% were concerned that they 'may be viewed negatively by [...] peers' 16% felt 'embarrassed/like a failure' and 13% expressed concerns about publishing null results as potentially having a 'negative impact on my career'.

> *"I will not say these are negative results. If we did our experiments properly without any mistakes then [the] data that we get still describe a new result."*
> **– Malaysia, Medicine, PhD or Master's Student in a University/ College**

3.1.2 Confusion about where and how to submit

For those who have generated null results and think that sharing them is important, but who did not share or try to share them (n=1,489), the second biggest concern is not knowing which journal to submit null results to (52%). Additionally, 29% also responded that they do not know how to submit null results to a journal.

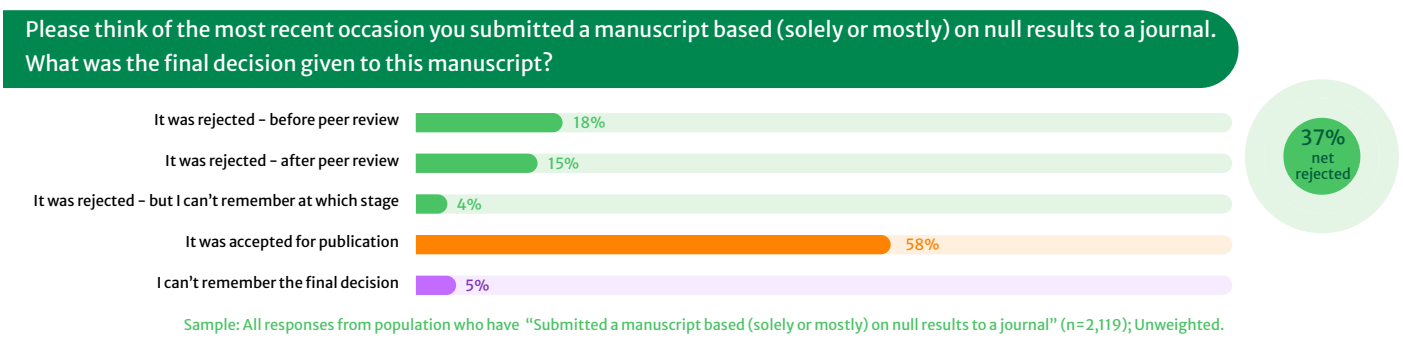
Across all survey respondents (n=11,069), only 15% of researchers were aware of a journal that encourages publication of null results.

3.1.3 Likelihood of being unsuccessful

Convincing researchers that it is important to share null results is one key component of the challenge in encouraging null-results based submissions – researchers will need their publishing-related concerns, such as the likelihood of acceptance, to be addressed. 82% of researchers agreed with the statement that 'null results are less likely to be accepted for publication at a journal' as being their greatest concern when submitting to a journal (n=11,069).

For those who had previously submitted a manuscript based (solely or mostly) on null results to a journal (n=2,119), more than half (58%) reported that their submission had been accepted for publication, 37% had been rejected, and 5% of respondents could not remember the final decision.

Figure 9: The ultimate acceptance rate for manuscripts including null results



Sample: All responses from population who have "Submitted a manuscript based (solely or mostly) on null results to a journal" (n=2,119); Unweighted.

Of those rejected (n=777), 93% think that the inclusion of null results played a role in the publisher's decision. Authors who were rejected before peer review were the most likely to feel that the inclusion of null results played a major role in the rejection decision.

Because of the perceived bias not just by researchers but by journals, there is scepticism about the value of investing time into publishing null results. 26% of survey respondents believe that 'the benefits of publishing an article based on null results are outweighed by the time and effort required to write it,' whilst 20% consider it 'too time consuming' (n=1,489). This sentiment may stem from the expectation that multiple journal submissions are often required before a manuscript is accepted.

Some respondents shared experiences in the open text comments to this effect, which suggests that the initial acceptance rate could be lower if based solely on the first submission. However, the survey did not investigate how many submission attempts are typically required for studies with positive results, leaving no direct basis for comparison.

> *"The negative effect to our group was that it took significantly more effort to publish the null result. We went through three submit/reject cycles before finding a journal that would accept it, versus typically one submission for a positive result. There is a larger negative effect for the field. My perception is that our first-choice journal would have reached the broadest audience with interest in the problem we identified. Instead, colleagues are unaware of our research in the fourth-choice journal, and the idea we disproved is continually described as plausible but untested."*
> **– United States, Physics, Research Scientist at a Government Institute or Agency**

> *"It was challenging to publish; it was almost published first in a well-respected journal in my field, and after going through the peer-review process twice and 6 months of extra work, [...] was rejected. Then, we went through 11 more journals and spent two years sending them to different journals until one found them interesting and promising. However, the angle of the manuscript had to be changed from completely "null results" to a slightly less negative perspective based on what we learned from it and what can be done in the future. Otherwise, we would not get it published."*
> **– Denmark, Medicine, Principal Investigator at a Medical school/Hospital/Clinic**

3.2 Were there any negative experiences as a result of publishing in a journal?

Amongst respondents who had published null results (n=1,228), only 20% experienced a negative outcome or outcomes, such as being viewed negatively by peers (8%), feeling like a failure (7%), or concerns it would negatively impact their career and reputation: 6% selected 'negative impact on my career,' 5% selected 'my citation metrics were negatively impacted,' 3% selected 'negative impact on my reputation in the field'. 16% had not experienced any negative outcomes.

Although the overall percentage of a negative experiences is small, acknowledging and exploring these negative experiences will enable us to assess what needs to change. In order to understand more, we asked respondents to elaborate how they knew, or why they thought, these outcomes had occurred.

> *"[...] at a subsequent conference the audience was underwhelmed and I felt embarrassed. [...] I think this is a perfectly legitimate kind of research to publish and am frankly horrified at the attitude I encountered. Reacting adversely to such results is not what science is all about. They could be a springboard to further research."*
> **– United Kingdom, Social Sciences, Professor at a University/College**

"Science often makes us feel like failures. All the more so when, after years of careful theory work and even some preliminary evidence of the "desired" effect, a full, expensive study ends up saying, "nah, all of this is random, you recorded only noise". It can be very demotivating and depressing [...]"
– Germany, Social Sciences, Postdoc at a University/College

"Publishing our null results created some personal tension with another research group that promotes the dependent measure which repeatedly generated the null results for us."
– United States, Social Sciences, Professor at a University/College

"Published a paper showing that a highly touted method from a famous group is unreliable for some cases. The result was loss of a grant. The paper now is well cited, but the effect on my career was entirely negative."
– United States, Physics, Professor at a University/College

These experiences could reflect the competitive nature of funding and a lack of understanding of the value of sharing null results. Raising awareness and educating researchers about the benefits of sharing null results could help to remove this stigma.

3.1.4 Lack of support

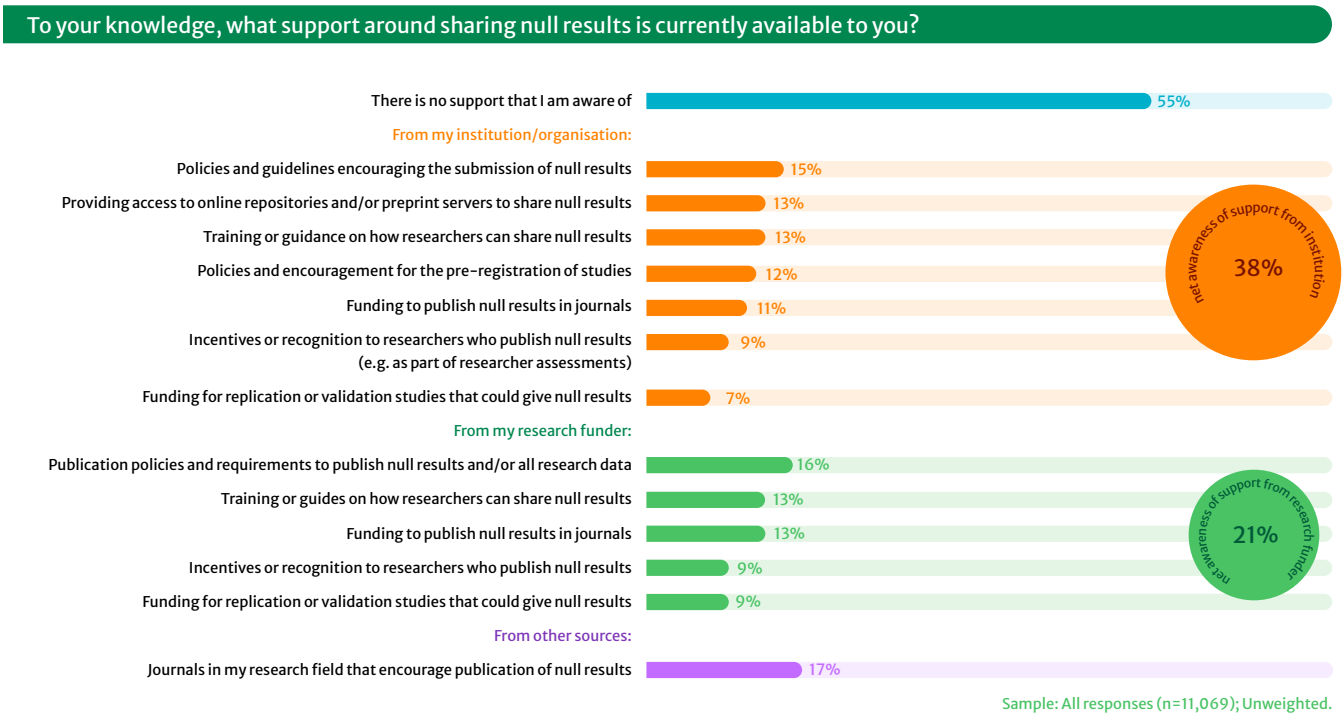
19% of respondents were concerned that their institution or funder would not cover the cost of publishing null results, and 9% reported that their institution or funder does not permit them to share null results, which points to a lack of support in publishing null results.

When asked in a separate question about the support for *sharing* null results that they were aware of (n=11,069):

- 55% responded that they were unaware of any support being available
- Overall, 45% were aware of at least one type of support from either their institution/ organisation, their research funder, and/or journals
- 38% were aware of support from their institution such as: policies, guidelines, trainings, access to online repositories and/or preprint servers, policies and encouragement for pre-registered reports, funding, and incentives or recognition
- 21% were aware of support from their research funder such as: policies and requirements, training or guides, funding, incentives or recognition
- 17% responded that there were journals in their field encouraging publication of null results

An assessment of the accuracy of reported perceptions was beyond the scope of this paper.

Figure 10: Awareness of types of support available for sharing null results



There is an indication from survey responses that providing support translates into action. Compared to those unaware of any support from their institution or funder, researchers who were aware of at least one of the listed types of support (72%) were more likely to have shared – or tried to share – their null results (if applicable), including submitting a manuscript based on their null results to a journal (34%).

For further context, a chart presenting an overview of the survey respondents' publication behaviour can be found in Figure 13, Appendix A.2.2.

References

[10] Springer Nature. (2025). *The state of research assessment: Researcher perspectives on evaluation practices*. https://stories.springernature.com/state-of-research-assessment

Intentions to publish null results in a journal

4.1 Factors influencing willingness to publish null results

Less than half of respondents (46%) said that they would be somewhat or very likely to write a journal article based on null results generated during a future research project, with 35% somewhat or very unlikely, and 20% unsure (n=11,069, with percentages rounded up to the nearest whole number).

Unsurprisingly, those who feel it is important that researchers share null results by any channel, and those who have previously submitted a null-results based manuscript, are the most likely to expect that they will write a journal article based on null results in the near future.

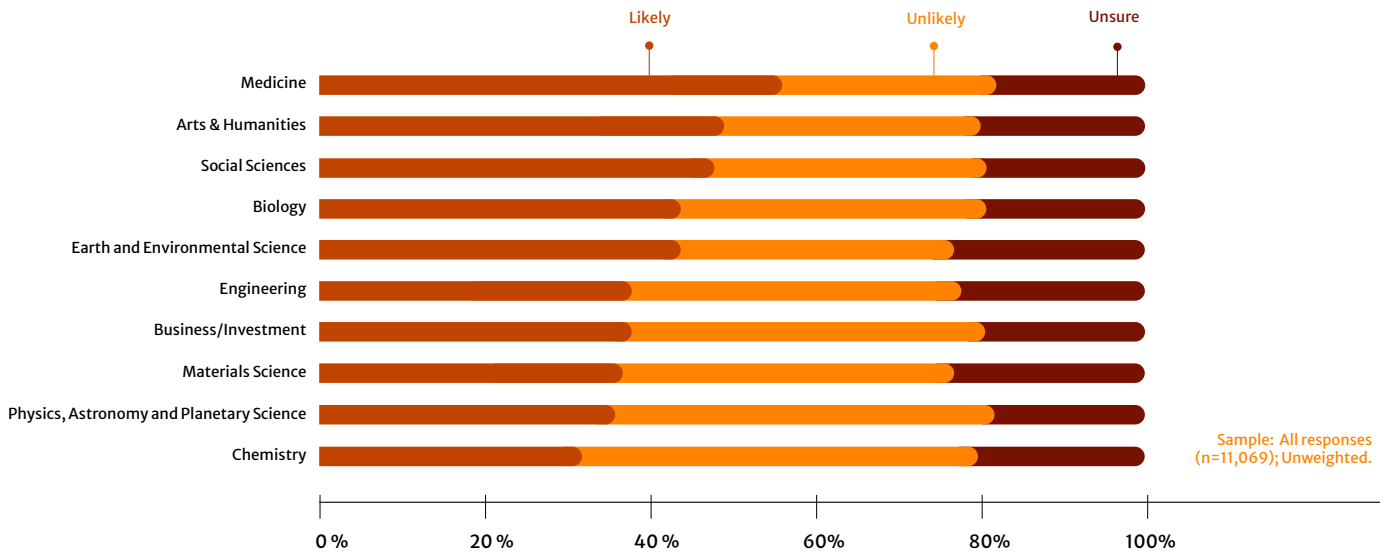
4.2 Variations by discipline, region, and career stage

There was also a general observation of a positive relationship between perceived importance of sharing null results and the willingness to do so. Responses varied by subject area, as disciplines which place greater importance on null results sharing are also more likely to be willing to share null results.

For example, researchers in Medicine – who are the most likely to feel sharing null results is important and to have submitted a null results-based manuscript previously – are also the most likely to anticipate that they would write a null-results based manuscript in the future (56%).

Figure 11: Future likelihood of publishing null results in a journal varies by subject area

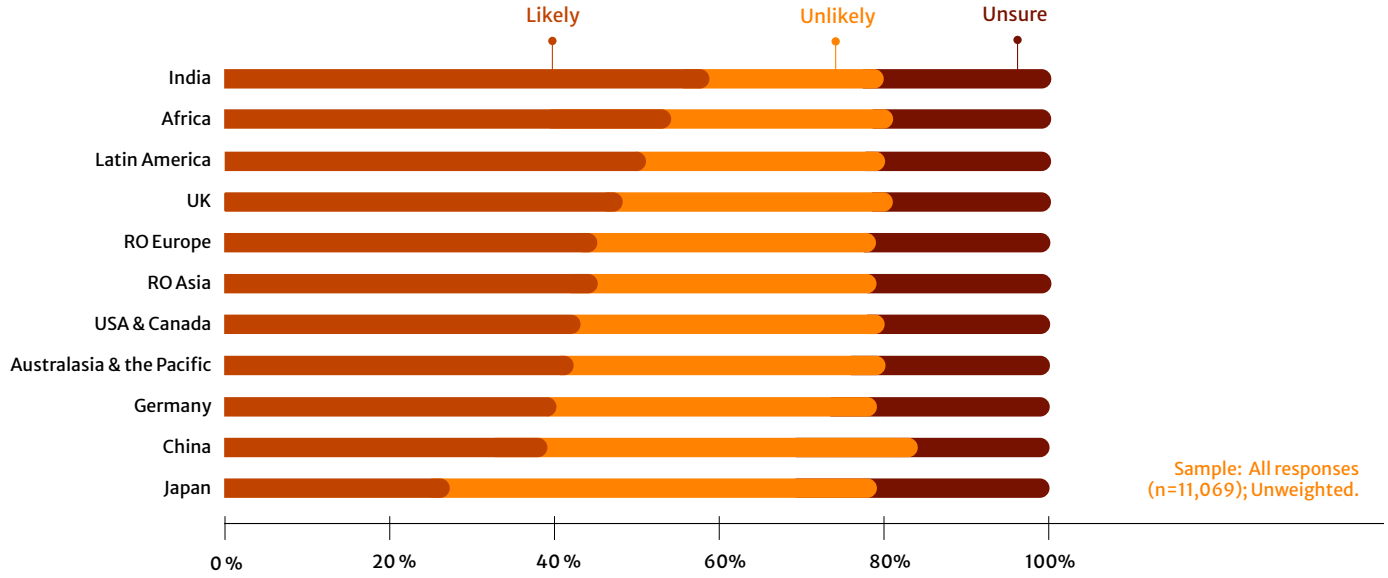
What is the likelihood that you would write a journal article based (solely or mostly) on the null results generated during the research project?



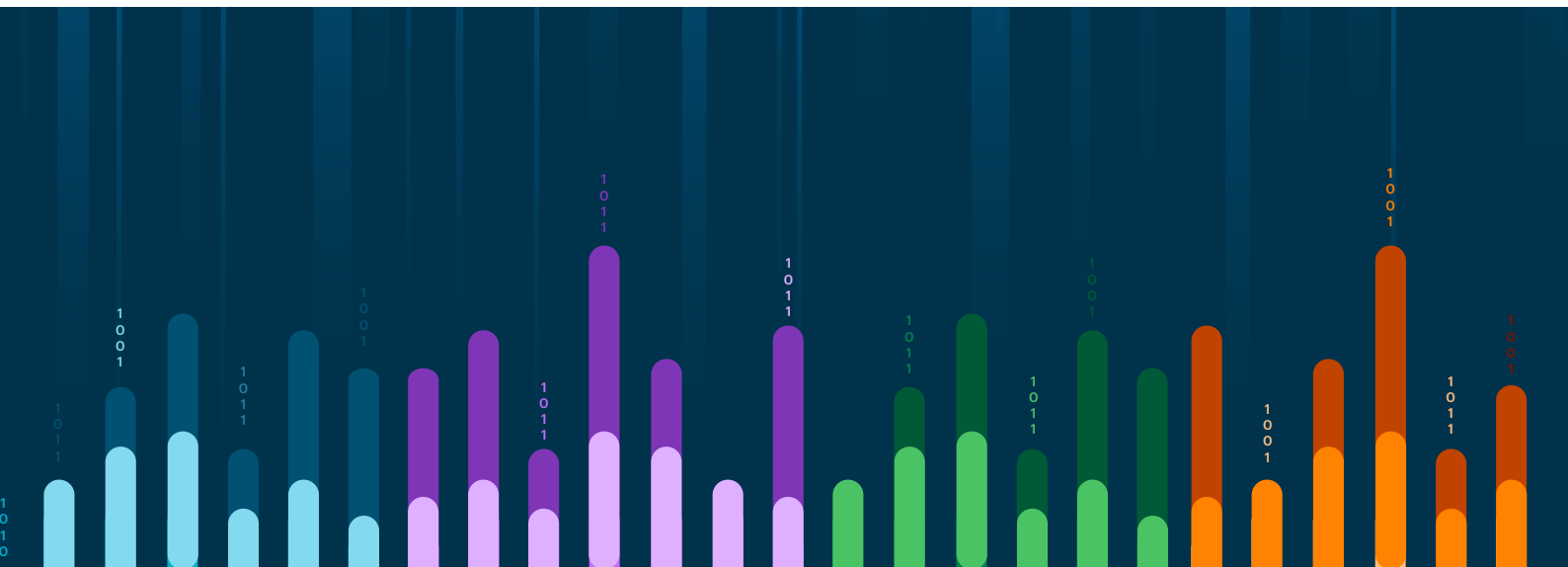
Looking at responses by region, the anticipated likelihood of submitting an article based on null results to a journal is greatest in India (59%), Africa (54%), Latin America (51%), and the UK (48%). Japan and China were the least likely countries to submit a manuscript based on null results (27% and 39% respectively).

Figure 12: Future likelihood of publishing null results in a journal varies by region

What is the likelihood that you would write a journal article based (solely or mostly) on the null results generated during the research project?



The seniority of the researcher did not affect responses, with similar levels of respondents saying they were likely to submit: 44% early career researchers, 48% mid-career researchers and 45% senior career researchers. Whether they were unlikely or unsure followed a similar pattern.



Recommendations to encourage the publication of null results in journals

Concerns about publishing null results in a journal broadly fit into four categories:

- Concerns about negative bias
- A lack of understanding where and/or how to submit
- Concerns about whether submissions would be accepted for publication
- A lack of support

To tackle the gap between intention and action previously described, recommendations have been suggested below based on the survey data, identifying relevant stakeholders who could take ownership for each solution. Some recommendations are repeated as they have the potential to solve more than one challenge.

All stakeholder groups

Challenges:
Tackling negative bias — whether from peers, researchers feeling embarrassed, or journals unlikely to accept such submissions.

-and-

Practical concerns – time/effort needed, co-author approval, lack of funding for open access (article processing charges).

Recommendations:
Improve perception of null results through educational and awareness campaigns. Highlight benefits and success stories or case studies, with a focus on messaging around reducing research waste.

Use the right terminology when talking about null results to avoid negative connotations.

Challenge:
Insufficient awareness of how and where to publish.

Recommendation:
Provide guidelines or tips on where and how to publish.

Challenge:
Perceptions that publishing null results has a negative impact on career.

Recommendations:
Move forward conversations around the reform of current research assessment systems to reward researchers for good publication practices.

Improve perception of null results through educational and awareness campaigns. Highlight benefits and success stories or case studies.

Challenge:
Insufficient incentive to publish null results.

Recommendation:
Move forwards conversations around the reform of the current research assessment systems.

Challenge:
Insufficient philosophical buy-in.

Recommendation:
Improve perception of null results through educational and awareness campaigns. Highlight benefits and success stories or case studies.

Institutions

In addition to the list of potential solutions suggested for all stakeholders, institutions could help solve the below challenge.

Challenge:
Practical concerns – time/effort needed, co-author approval, lack of funding for open access (article processing charges).

Recommendation:
Provide funding for the open access publication of null results.

Funders

In addition to the list of potential solutions suggested for all stakeholders, funders could help solve the below challenge.

Challenge:
Practical concerns – time/effort needed, co-author approval, lack of funding for open access (article processing charges).

Recommendation:
Provide funding for the open access publication of null results.

Publishers

In addition to the list of potential solutions suggested for all stakeholders, publishers could help address the below challenges.

Challenge:
Tackling negative bias — whether from peers, researchers feeling embarrassed, or journals unlikely to accept such submissions.

Recommendations:
Clearly share null results policy on journal homepages.

Advertise acceptance rate for articles based on null results (if supporting data is found).

Consider introducing journal sections dedicated to null results.

Provide policy guidance to journal editors and peer reviewers on null results.

Challenge:
Insufficient awareness of how and where to publish

Recommendation:
Clearly share null results policy on journal homepages.

Recommendations for targeting

Where relevant, targeting specific subject areas, regions or seniority of researcher may be more effective than applying a uniform approach across the board.

By subject area

Medicine, Biology, and the Social Sciences are likely to be easier to encourage article submissions based on null results, since these researchers show the greatest philosophical and behavioural buy-in to sharing null results. However, the perception of negative publication bias and limited awareness of which journals consider null results persists. Clarifying policies on journal pages should make this clearer, so that a home for null results is easy to find.

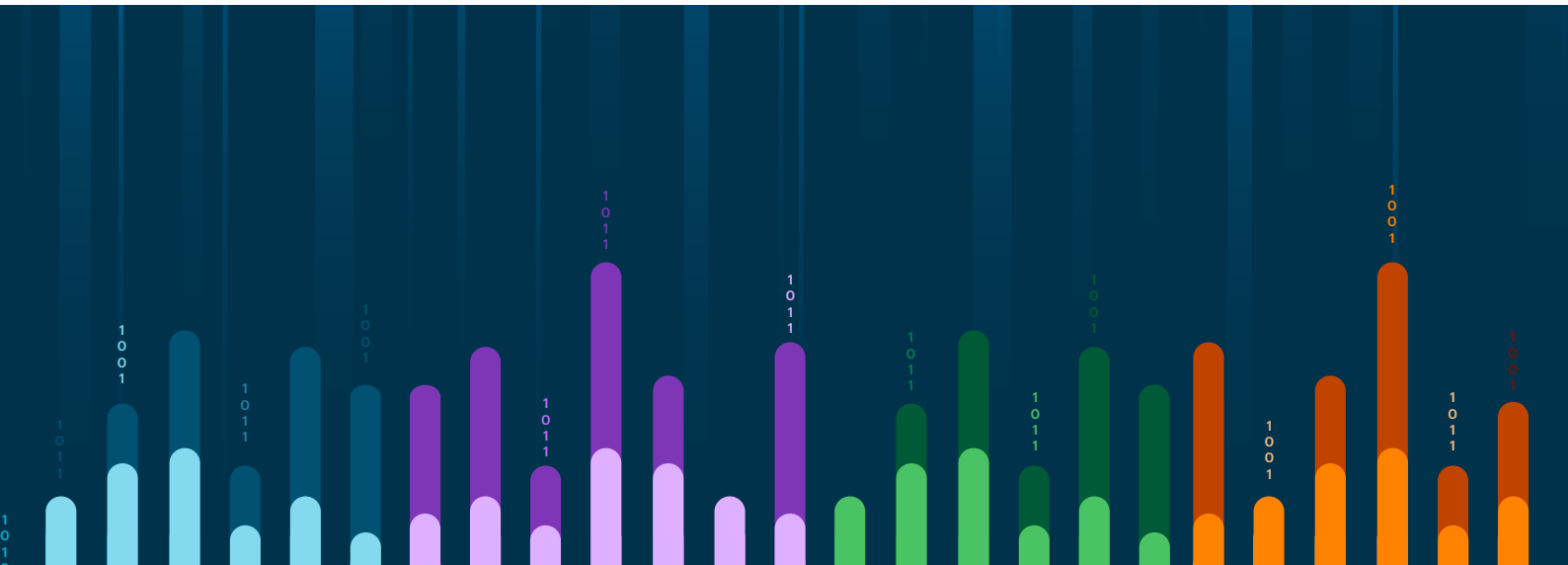
By region

Researchers in Europe, Australia and North America have the greatest philosophical and behavioural buy-in to sharing null results, but the majority hold at least one concern when it comes to publishing those results (lower likelihood of acceptance, and not knowing which journals to submit to). Ensuring that these researchers are aware of journal policies can mitigate against these concerns.

Researchers in Africa and Asia – particularly Japan - have the lowest philosophical and behavioural buy-in to sharing null results. Running educational and awareness campaigns, highlighting the benefits of publishing null results and including success stories or case studies should improve these researchers' perception of null results

By seniority

Early career researchers may require greater encouragement to consider publishing null results before they are established in their career or confident in their research (as to defend their methodology or feel able to explain why they generated null results). Concerns regarding how they will be viewed by peers can be addressed by illustrating how common null results are and that it is a natural part of the research process which should be associated with transparency and rigour, rather than failure. Early career researchers could benefit from examples of how publishing null results can benefit one's career, especially early on, as well as being given access to funding for publishing null results, and having a research assessment framework that acknowledges the value of both null and positive publications.



Conclusion

Null results are common in scientific research, as not every experiment or study will confirm the initial hypothesis. Recognising null results as a natural and valuable part of the research process, rather than a failure, is key to advancing scientific knowledge.

The benefits of publishing null results in a journal are clear: they contribute to the overall understanding of a topic; promote transparency and rigour; and help prevent unnecessary duplication of research efforts thereby reducing the waste of funding. Moreover, publishing these findings enables them to reach a global audience rather than remaining limited to a researcher's immediate network or conference attendees, leading to greater equity. Yet there is a notable disparity between how researchers value null results and how they believe their peers perceive null results.

Whilst personal attitudes towards null results are largely positive or neutral, perceived attitudes held by peers are less constructive. Concerns about negative bias, co-author reluctance to share null results widely, and negative reception from peers, institutions, and research funders contribute to an attitude–behaviour gap.

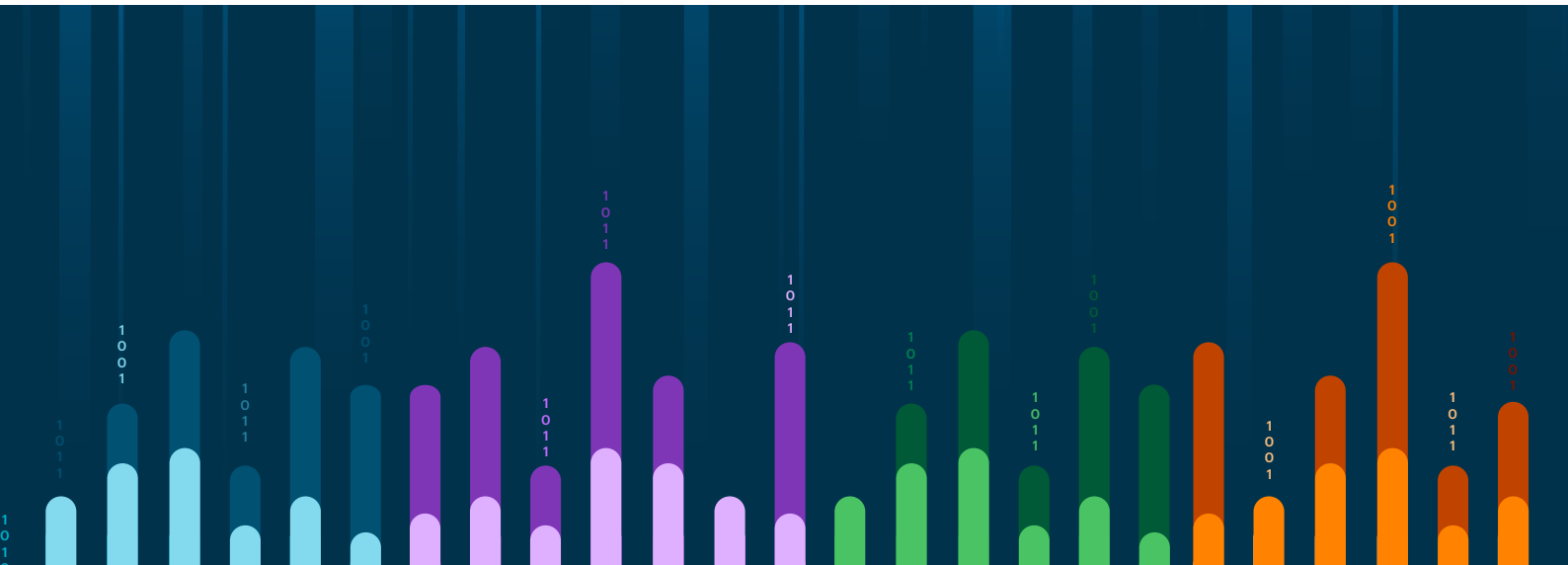
This issue largely stems from the lack of recognition given to researchers who publish null results because of the limitations of current research assessment practices. Without fair and inclusive metrics, there is little incentive for researchers to invest time and effort into publishing these valuable results.

Supporting and encouraging researchers that it is important to share null results and addressing their publishing-related concerns is crucial to encouraging submissions based on null results. These concerns include a lack of understanding of where and how to submit null results, and doubts about whether submissions will be accepted for publication.

To bridge this gap, following recommendations for each stakeholder group in the academic community is essential. These can be summarised as below:

- Educational and awareness campaigns to improve perceptions of null results
- Funding and institutional support to help researchers share null results openly
- Clearer journal policies with guidance for editors and peer reviewers
- Stakeholder collaboration to advance research assessment reform

By collectively addressing researchers' concerns and challenges, we can foster an environment where null results are valued and published, ultimately benefiting the entire academic community.



About null results at Springer Nature

Springer Nature publishes a range of research journals, some of which are inclusive and aim to publish all in-scope, technically sound research, others are more selective; all publish papers that have been rigorously peer reviewed. Examples of inclusive journals include *Scientific Reports*, the BMC Series, the Discover Series, and the Cureus Journals series. Examples of selective journals include *Nature* and Nature research journals as well as other journals from the Nature Portfolio and Springer. All of these journals consider submissions that report null results, as well as foundational and fundamental advances and descriptive papers on protocols and data sets, which also support reproducibility and data sharing.

How to cite this white paper

Springer Nature (2025, July). *The state of null results: Insights from 11,000 researchers on negative or inconclusive results.*
stories.springernature.com/the-state-of-null-results-white-paper/index.html

Acknowledgements

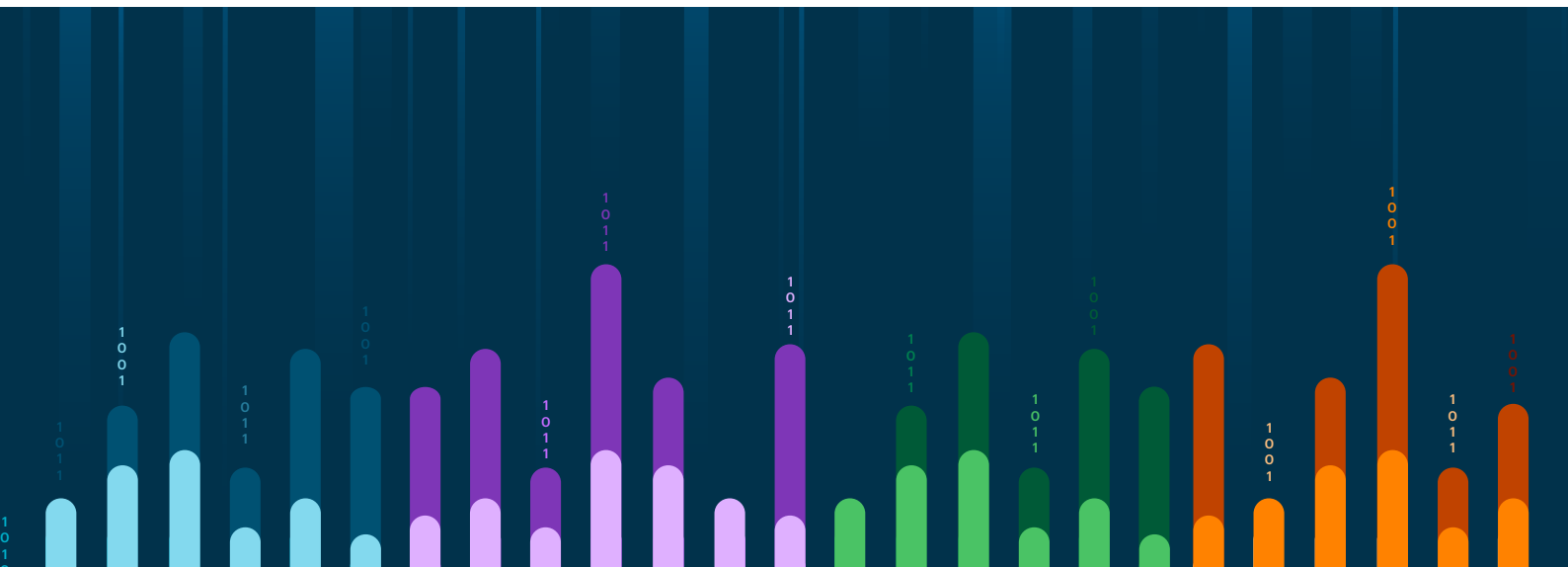
With thanks to all researchers who took the time to respond to this survey, and reviewers of this white paper.

Authors:

Christina Emery
Head of Thought Leadership Programmes
Springer Nature

Chloe O'Donnell
Senior Research Analyst
Springer Nature

Ritu Dhand
Chief Scientific Officer
Springer Nature



Appendices

A.1 Terminology

The definition of 'null results' used throughout the survey was shared upfront.

'Null results' are also commonly referred to as 'negative results' or 'inconclusive results'.

For the purpose of this survey, a 'null result' is defined as **an outcome that does not confirm the desired hypothesis**.

- It does not denote that there were no results, but rather a lack of expected content or results that do not support the hypothesis.

Examples could include:

- When a survey, study or research concludes that there is **no correlation** between responses or evidence and the hypothesis.
- When an experimental result **does not support the hypothesis** or is **not significant** enough to draw conclusions.
- When **no significant improvement** is found through introducing a new method or solution.

97% of 12,954 journal authors surveyed self-reportedly understood the definition provided, however when asked about the terms that they primarily use themselves, 'null results' was only used by 24% of respondents (n=11,069).

'Negative results' and 'inconclusive results' were the top two terms used by respondents (33% and 32% respectively), with 8% using another term (such as 'non-significant results'), and 3% not having heard of the concept before (n=11,069).

In addition to there being wide variation in the terminology used, respondents noted that it can change depending on the circumstances, with a variation also noted by seniority, discipline, and region. Survey respondents also reported a negative connotation to using the term 'negative results'.

A.2 Methodology

A.2.1 Procedure

Springer Nature conducted a survey in order to gain insights into researcher attitudes towards and experience of sharing research consisting of mostly or solely null results – including:

1. Attitudes towards null results
2. Experience of using or sharing null results, particularly via journal publication
3. Current barriers to publishing null results in journals
4. Key players and initiatives in encouraging the journal publication of null results

A mixture of quantitative (closed) and qualitative (open text) questions on these four topics were posed to researchers in Springer Nature's audience who have published and expect to publish again in peer reviewed journals (at any publisher, not limited to Springer Nature). The survey questions freely available through the Figshare repository – see Appendix 4.

The survey was programmed and hosted online on Qualtrics, a third-party survey platform provider, and used Springer Nature branding. The survey was available in English, German, French, Chinese (Simplified), and Japanese to encourage a global sample.

The survey was live for two months, from 6th November 2024 to 6th January 2025. It was distributed via 17 campaigns across numerous channels including email (to subscribers on Springer Nature marketing lists and members of the Market Intelligence team's research panel), social media (LinkedIn, Facebook, X, WeChat, Weibo, Medsi.cn, Sciencenet.cn, Bilibili, Zhihu); blog posts (on Springer Nature's Researcher Community and Editor Community sites); and site intercepts (on springer.com, springeropen.com, nature.com, and bmc.com) via official Springer Nature channels.

All respondents were invited to enter a prize draw to win one of five USD$100 Visa® Virtual Gift Card (or regionally available virtual gift card to the value of USD$100USD). Survey responses were not associated with prize draw entries as to maintain anonymity, so answers did not affect the chances of winning the prize draw. The incentive was purchased and distributed via Tremendous, a third-party gift card & rewards platform for businesses.

A.2.2 Sample

Due to the distribution methods, the survey sample is limited to Springer Nature's audience (its website users; news, journal and book readers; social media followers; marketing list contacts) and the networks of any persons who may have shared the survey. The survey findings should be interpreted with this in mind.

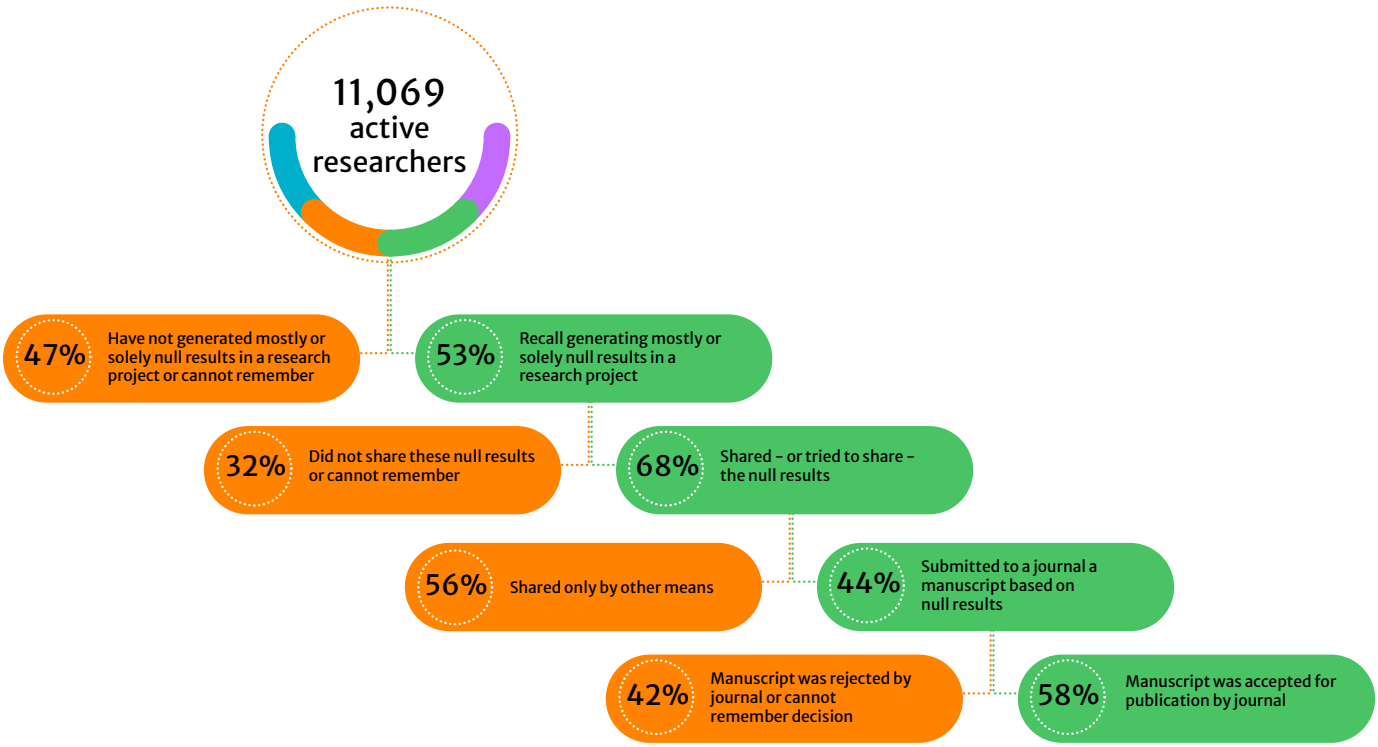
It should also be noted that there is the possibility of self-selection bias in the survey sample, as those who are aware of and feel strongly about null results may be more likely to complete the survey.

Only responses that met all of the following inclusion criteria were included in the final survey sample: i) qualify for the survey (have self-reportedly previously published an article in a peer-reviewed journal and expect to publish an article in peer-reviewed journal in the future); ii) confirmation to have read and understood the provided definition of 'null results'; iii) have completed the entire survey; iv) not identified as a duplicate response; v) not flagged as likely fraudulent (using the fields 'Q_RecaptchaScore,' 'Q_RelevantIDDuplicate,' 'Q_RelevantIDFraudScore,' and 'RelevantID Fraud check' automatically generated by Qualtrics).

In total, 22,612 respondents opened the survey and 20,759 started the survey (answering at least the first survey question). Of the 20,759 responses that started the survey, a total of 9,690 were excluded from the final survey sample because they did not meet all the inclusion criteria. The total base size of respondents who met all inclusion criteria for the final survey sample was 11,069. As such, 49% of those who opened the survey, and 53% of those who started the survey, were included in the final survey sample.

Throughout this report, the total number of respondents is reported per question, as not every respondent was eligible for every survey question.

Figure 13: Overview of survey results



A.2.3 Analysis

The data was analysed using Q Research Software. The dataset was unweighted.

The data was analysed by region, broad subject field, seniority (based on job title and year of first journal publication), and, where useful, responses to other survey questions such as those regarding attitudes toward null results or experience of sharing research consisting mostly or solely of null results. There is no differentiation between industry as trends were more significant by broad subject field.

For cross-tabulations, column comparisons used significance levels $p \leq 0.05$ and $p \leq 0.001$, and False Discovery Rate (FDR) ($p = 0.05$) was used for multiple comparison correction. Significant differences were highlighted throughout this report.

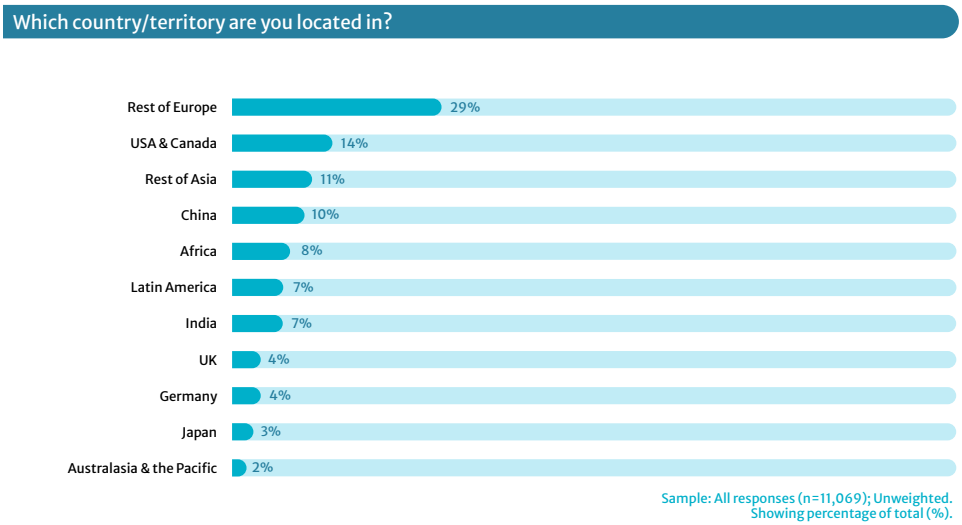
The anonymised raw data is freely available through the Figshare repository – see Appendix 4.

A.3 Demographics

The global survey received responses from respondents spanning 166 countries.

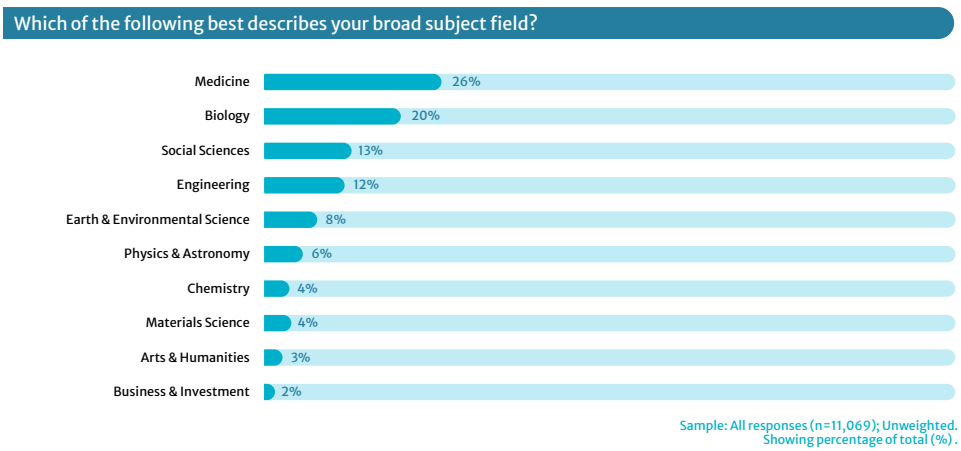
For the purpose of analysis, countries were grouped into continents. However, a few countries with particularly high journal publication output were analysed separately, as their trends may differ significantly from regional patterns.

Figure 14: Which country/territory are you located in?



Respondents worked across a range of broad subject fields, though those in Medicine or Biology were highly represented in the sample, comprising 26% (n=2,928) and 20% (n=2,269) of the total sample, respectively).

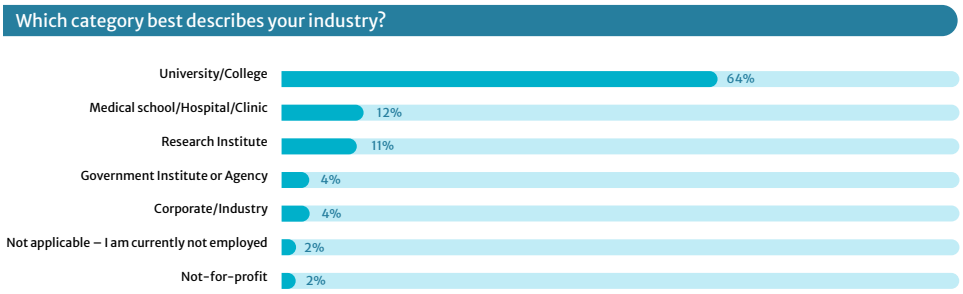
Figure 15: Which of the following best describes your broad subject field?



For analysis by broad subject field, 'Physics' and 'Astronomy and Planetary Science' have been merged into 'Physics & Astronomy' as 'Astronomy and Planetary Science' had a relatively low base size and answers were similar to that of 'Physics' respondents' answers.

While respondents worked in a variety of settings, the majority worked in university/college (64%, n=7,094) so the sample predominantly represents researchers in academia.

Figure 16: Which category best describes your industry?



For the purpose of analysis, respondents' job titles were grouped by the relative seniority of the job title. Under this categorisation, approximately one third of the total sample were mid-career researchers (34%, 3,794) and almost one third were senior career researchers (30%, n=3,290).

Figure 17: Which of the following job titles best applies to you?

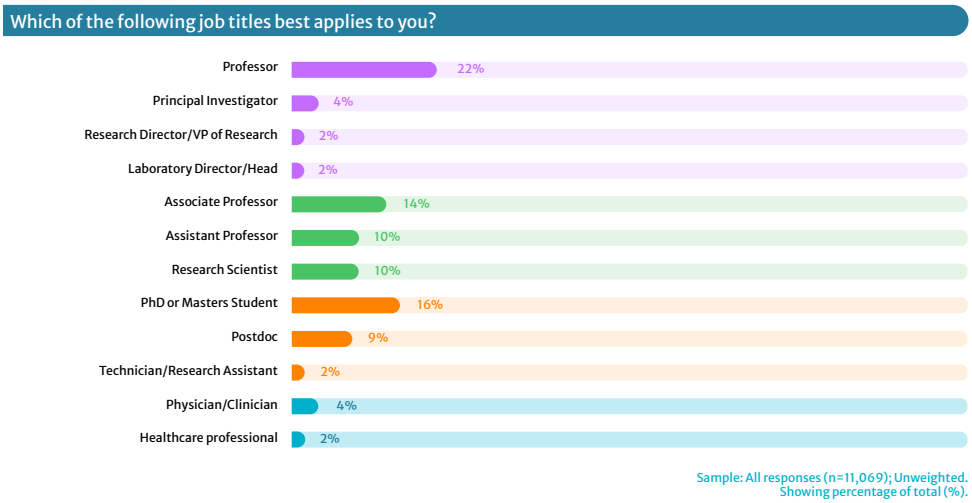
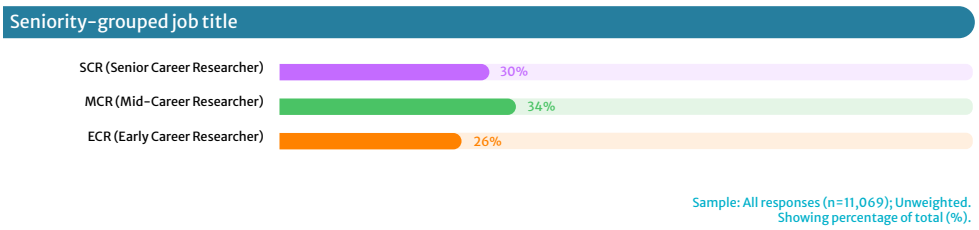


Figure 18: Which of the following job titles best applies to you



Senior career researcher: Professor, Principal Investigator, Research Director/VP of Research, and Laboratory Director/Head

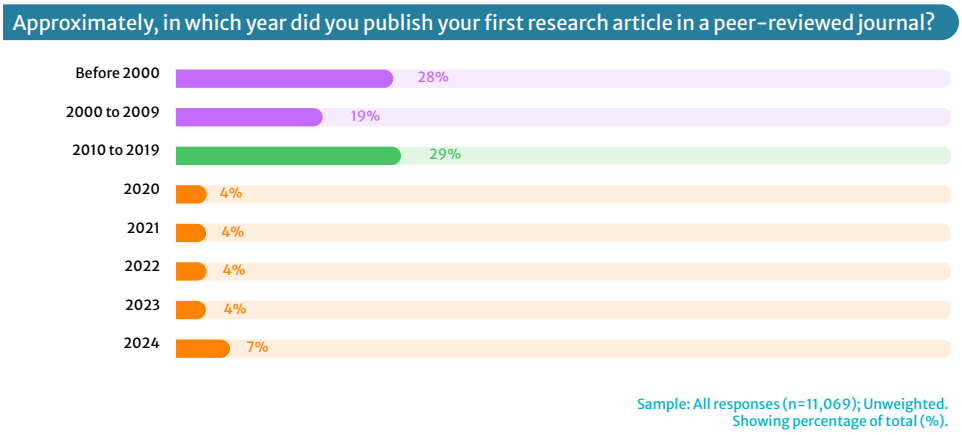
Mid-career researcher: Associate Professor, Assistant Professor, and Research Scientist

Early career researcher: PhD or Master's Student, Postdoc, and Technician/Research Assistant

Physician/Clinician and Healthcare profession were not categorised and therefore excluded from analysis by seniority based on job title.

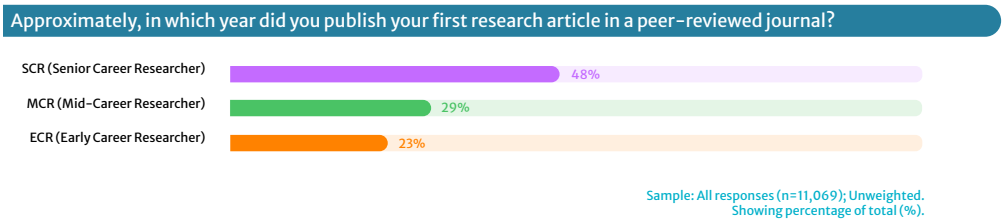
Another way to consider seniority, with respect to a survey focused on journal publishing behaviour, is the number of years' experience in publishing their research in journals. For the purpose of analysis, the number of years' experience was also grouped by the relative seniority of the duration of experience. Under this categorisation, almost one half of the total sample were senior career researchers (having published their first research article in a peer-reviewed journal before 2010: 48%, n=5,265).

Figure 19: Approximately, in which year did you publish your first research article in a peer-reviewed journal?



Sample: All responses (n=11,069); Unweighted.
Showing percentage of total (%).

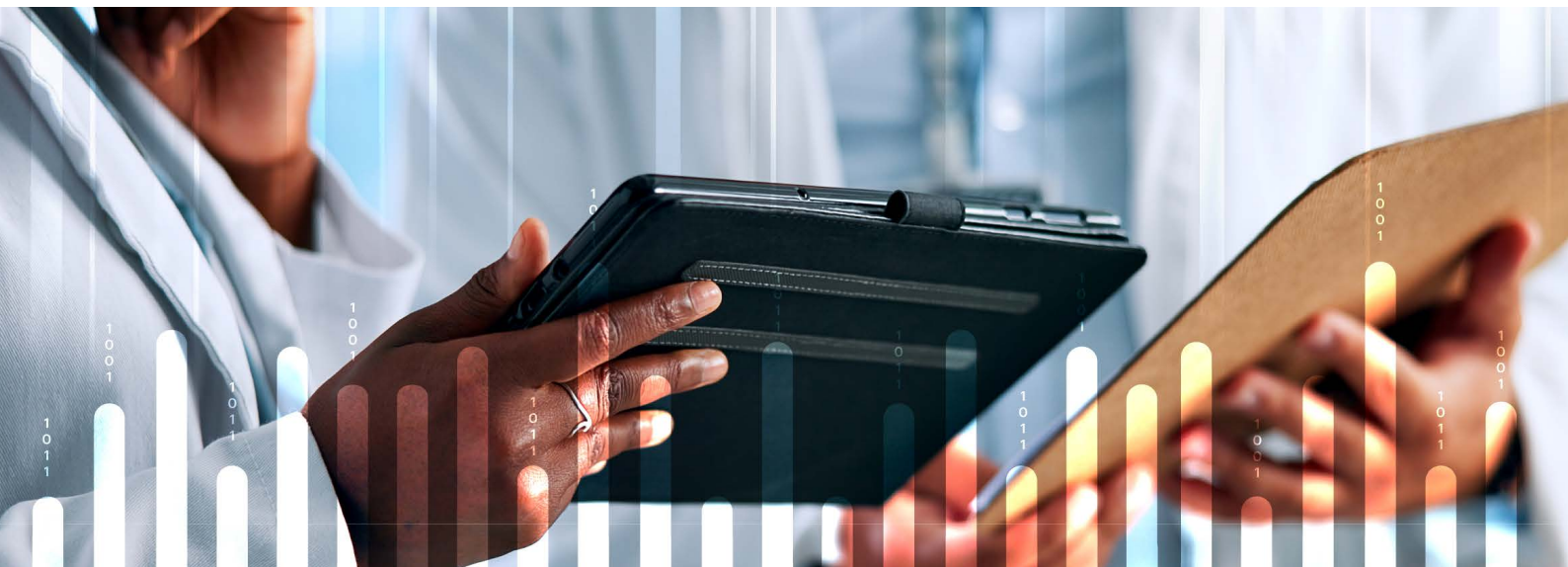
Figure 20: Approximately, in which year did you publish your first research article in a peer-reviewed journal?



Sample: All responses (n=11,069); Unweighted.
Showing percentage of total (%).

A.4 Survey questions and data

Survey questions and anonymised data are available at:
https://doi.org/10.6084/m9.figshare.29459036



SPRINGER NATURE

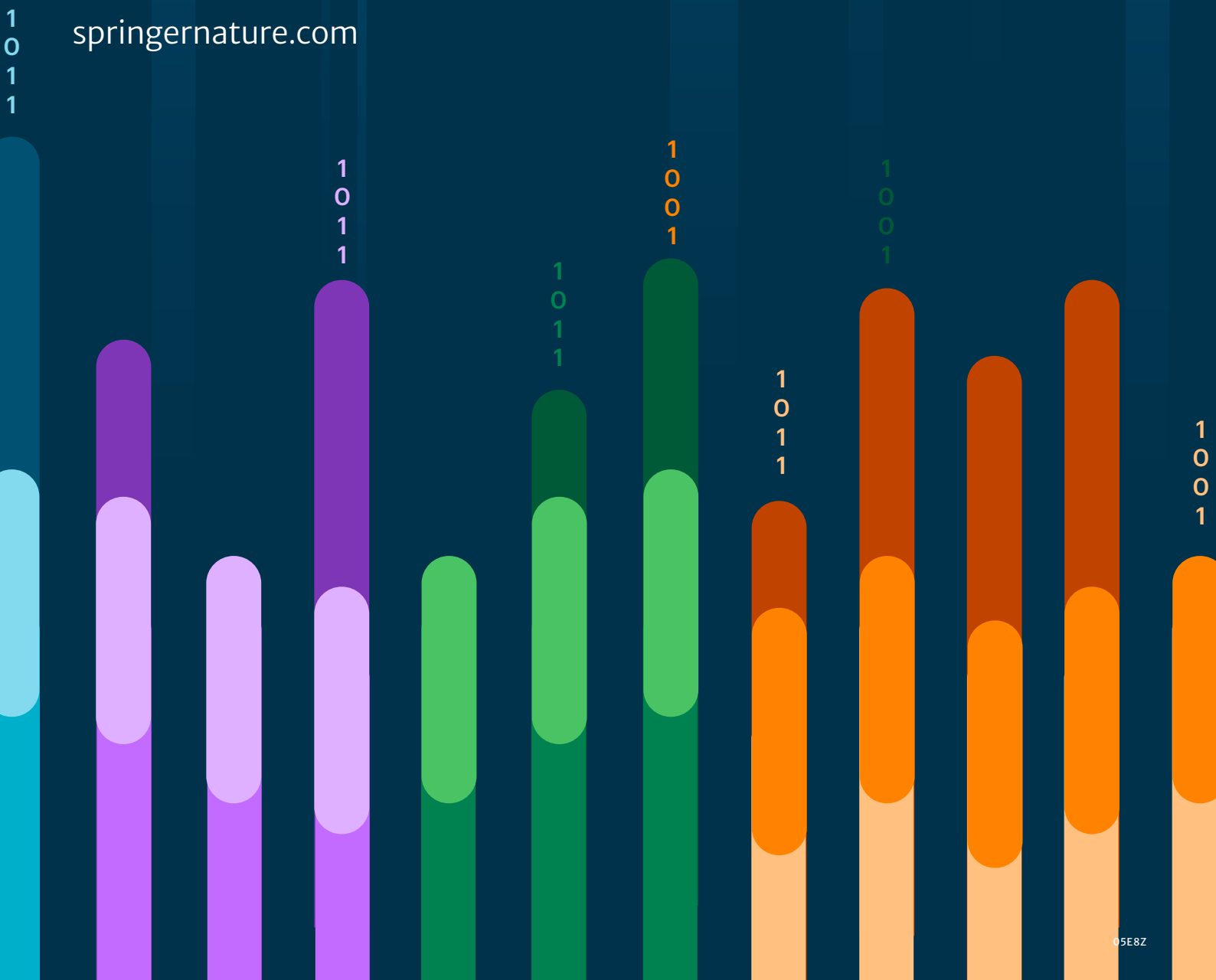
Share your thoughts

We'd love to hear your feedback on this study. Please share your thoughts by completing this short poll.

The white paper can be accessed online here

stories.springernature.com/the-state-of-null-results-white-paper

springernature.com



05E8Z