

ECONOMIST
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Confidence in research: researchers in the spotlight



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About the Research

Confidence in research: researchers in the spotlight is an Economist Impact report, supported by Elsevier. In the report, Economist Impact explores the attitudes of scientists, scholars and researchers – from now on referred to primarily as researchers – on how the pandemic has affected the practice of undertaking and communicating research in the face of increased public scrutiny. The pandemic underscored the vital importance of public trust in research. The starting point for our research is that public trust in science and research depends, in part, on whether the research community itself is confident in its ability to produce high quality and relevant research. This requires not only analysis of how the support and incentive structures for the research community are viewed as a whole, but also the skills that researchers need to navigate a new, more public-facing landscape for science and research.

The research presented in this report was undertaken between December 2021 and August 2022. This research forms part of a broader global collaboration on understanding the drivers of confidence in research that Elsevier has launched this year.

Based on findings drawn from a literature review, a global survey of researchers, an advisory board, and qualitative interviews, as well as discussions from six regional roundtables organised by Elsevier and its convening partners, and Elsevier's 'Global Expert Panel', our research seeks to

identify actionable insights and interventions for the research community to take forward to bolster research practice and confidence in research.

This report was written by Martina Chow and Jonathan Birdwell. Many other Economist Impact colleagues contributed to the research and report design, including: Candice de Monts-Petit, Jeremy Kingsley, Sardar Karim, David Humphreys, Tom Nolan, Valeria Couttolenc, Antonia Kerle, and Maria Gonzalez.

Advisory board members

Our thanks and gratitude are due to the following people (in alphabetical order) for their time and guidance on the research:

1. **Dr Agnes Binagwaho**, Vice-Chancellor, University of Global Health Equity, Rwanda
2. **Dr Cary Funk**, Director of Science and Society Research, the Pew Research Center
3. **Dr John Grove**, Chief Evaluation and Learning Officer, Global Fund; and former Director of Quality Assurance for Norms & Standards, World Health Organisation
4. **Dr Heide Hackmann**, Senior Advisor for Transdisciplinarity and Global Knowledge Networks, Centre for the Advancement of Scholarship of the University of Pretoria and Interim Director for Future Africa

5. **Dr Richard Horton**, Editor-in-chief, The Lancet
6. **Dr Reiko Kuroda**, Professor at Chubu University, Japan and Professor Emeritus at The University of Tokyo
7. **Dr Nick Perkins**, Board Member of International Science Council
8. **Dr John Pham**, Editor-in-chief, Cell
9. **Dr Wim van Saarloos**, Chair of the Energy Programme, European Academies Science Council (EASAC); Professor of Theoretical Physics, the Instituut-Lorentz, University of Leiden
10. **Dr Michael Saliba**, Professor & Director of the Institute for Photovoltaics (ipv), Stuttgart University
11. **Dr Karla Soares-Weiser**, Editor-in-chief, Cochrane Library
12. **Dr Jack Stilgoe**, Professor of Science and Technology Policy, Dept of Science & Technology Studies, Faculty of Maths & Physical Sciences, University College London
4. **Dr Ayumi Koso**, Director of NBRP Public Relations Office, National Institute of Genetics, Japan
5. **Dr Alejandro Miranda-Nieto**, Postdoctoral Fellow, Faculty of Social Sciences, Department of Social Work, Child Welfare and Social Policy, Living Conditions, Health, Work and Social Inequalities, OsloMet
6. **Dr Jose Mustre de Leon**, Director, Centre for Research and Advanced Studies (Cinvestav), Mexico
7. **Dr Job Mwaura**, Research Fellow at Stellenbosch University in South Africa.
8. **Dr Ayesha Siddiqi**, University Lecturer at the Department of Geography at University of Cambridge; Council Member, Arts and Humanities Research Council (AHRC)
9. **Dr Deborah Zarin**, Program Director, Advancing the Clinical Trials Enterprise at MRCT Centre of Brigham's and Women's Hospital and Harvard University

While Advisory Board members provided important feedback and input, the final survey questionnaire and research should not be taken as reflective of their views or endorsement. The research is independent, and all errors and omissions remain Economist Impact's responsibility alone.

Interviewees

Our thanks are due to the following people (in alphabetical order) for their time and insights:

1. **Dr Hjördis Czesnick**, Head of Office, the German Research Ombudsman
2. **Dr Sarah Iqbal**, Science engagement consultant, Foundation for Advancing Science and Technology (FAST India)
3. **Dr Francis Kombe**, CEO, EthiXPert, NPC-SA, Wellcome Trust funded DPhil student at the School of Applied Social Sciences (Psychology); University of KwaZulu-Natal (UKZN)

Roundtables

We would also like to thank the following organisations for allowing us to observe the roundtables that they organised and chaired with researchers, scientists and other experts. They included:

- Sense about Science, UK
- Research!America, US
- Körber Stiftung, Germany
- Koninklijke Hollandse Maatschappij der Wetenschappen (KHMW) - The Royal Holland Society of Sciences and Humanities, Netherlands
- Chinese Association for Science of Science and Science & Technology Policy (CASSSP), China
- Japanese Association for the Advancement of Science (JAAS), Japan

Foreword by Elsevier



Science and the research endeavour, alongside the herculean effort of healthcare professionals, have been the key to managing the Covid-19 pandemic. The global collaboration amongst researchers across borders, sectors and disciplines created an efficient system which delivered extraordinary breakthroughs and rapid innovation that save lives.

But the pandemic has also brought significant and enduring challenges for the research community, including increasing misinformation, politicisation of science and greater public scrutiny of research than ever before. While that scrutiny can drive further rigour and recognition,

it can also increase pressure on researchers – to publish their work earlier and more often, to identify reliable knowledge amidst an ever-growing sea of information, to communicate their research to a more generalist audience as well as policy makers. The research process doesn't lend itself easily to such pressures. It is rarely neat and definitive; indeed, it thrives on experiment and uncertainty, on nuance and complexity. Trust and confidence in research are vital for our collective ability to tackle the most pressing global challenges, from climate change to future pandemics.

As a scientific publisher and information analytics company, Elsevier has been privileged to play a role, for over 140 years, in helping ensure that quality research can be trusted, shared and built upon to accelerate progress for society. In that spirit, we have partnered with leading organisations dedicated to advancing research and science to initiate a global dialogue about how confidence in research has been affected by the pandemic and to identify practical solutions that can support researchers.

A critical part of this initiative is Economist Impact's *Confidence in research: researchers in the spotlight* study to understand the experiences of researchers, their own confidence in the research process and what skills, support or incentive structures they need in an increasingly complex and public-facing environment.

The findings reveal the extent and nature of the impact of the pandemic on the research community: the prevalence of misinformation, which underscores the importance of peer review and transparent study design as markers of confidence; the shocking online abuse targeted at researchers and the disheartening widened inequalities in access to funding and resources for early career researchers, women, and researchers in the Global South. Notably, researchers are concerned by the tension between awareness and understanding. Public attention on research has increased, bringing greater recognition and appreciation of research, but public understanding of how research is conducted has not risen in parallel. The findings show a clear call to equip researchers with the skills they need to communicate research with more clarity and confidence has come through in this study loud and clear.

Thanks to the invaluable input of academic leaders and early career researchers around the world, Economist Impact has surfaced a range of potential interventions that can help address these new challenges faced by the research community. We believe this report can be a helpful stimulus as all stakeholders in research come together to turn recommendations into action. At Elsevier, we are committed to supporting the research community to tackle these challenges.

I would like to thank Economist Impact, Sense About Science, our global thought partner, all our regional convening partners, Economist Impact's Global Advisory Board and Elsevier's Expert Panel, and the thousands of academic leaders, scientists and researchers who lent their time and invaluable perspectives to this important collaboration.

Kumsal Bayazit
Chief Executive Officer, Elsevier

Executive summary

Science and its practice are undergoing rapid change. The urgency of the pandemic accelerated open science and data sharing across borders, broadening access to research. Virtual collaborations amongst academic researchers and corporate R&D, as well as interdisciplinary and international collaboration helped to drive the extraordinary pace of innovation and breakthroughs. The pandemic also cemented the role of social media as a place for researchers to share their research, engage with others and debate findings.

Much of this has been positive for science and academic research more broadly. But the experience of the last two years has also highlighted serious challenges facing the research community.

The huge quantities of information, increasingly publicised before peer review, poses challenges to identifying information that can be relied upon, even for seasoned researchers. This information must be synthesised and shared with the public, media, and policymakers, and researchers are increasingly the messengers. But what are the longer-term impacts of this? Are researchers prepared for this public-facing role? Are they equipped to communicate complex, often nuanced findings to lay audiences? And are

they confident that the research community is providing them with support and incentive structures that are fit-for-purpose amidst this new landscape?

Our collective ability to tackle the most pressing global challenges, from climate change to future pandemics, depends on research, and on public trust in research.

These challenges are monumental on their own, but amid the backdrop of increasing misinformation and politicisation of science, it is critical to understand whether researchers themselves have confidence in the research landscape, and in their abilities to take on this more public-facing role.

Confidence, as we define it, is two-fold: on the one hand, it relates to **researchers' self-confidence**, and whether they have confidence in the integrity of research, in research processes and outcomes, in their research skills, and in their careers as researchers. On the other, it accounts for the **confidence that researchers have in their relationships with the wider research community**, from funders and policymakers to the media, the public, corporations, publishers, and their universities.

In this context, Economist Impact, with the support of Elsevier, has undertaken a major

study engaging the global research community (see: Research methodology).

Informed by a literature review, a global survey of the research community, expert interviews and roundtable discussions, the main research objectives are:

1. Evaluate **researchers' perceptions** of the impact of the pandemic on the production and communication of research;
2. Assess whether and how researchers have **changed their behaviour** as a result of the pandemic;
3. Identify **gaps in researchers' confidence** in the production and communication of research; and
4. Identify **interventions** that will help researchers effectively bolster both scientific practice and confidence in research

The centrepiece of the research is an Economist Impact survey of 3,144 researchers globally. Our survey captures the experiences and perspectives of researchers at different career stages, 'early-career', 'established' or 'distinguished'¹, across dozens of fields of expertise, and across academia as well as the private sector. Ironically, the research community itself can be difficult to research: they are often the conductors of research, rarely the subject themselves. Although we have taken steps to ensure coverage across disciplines and spread of responses across geographies, there may be self-selection biases in the data. And while the results should be interpreted with this in mind, our survey findings nevertheless provide strong signals that resonated

with researchers we spoke to. Our hope is that our survey and this report provide a basis for further research and help to spur a productive conversation within the research community on these important topics. Below we provide a summary of the key findings of the research.

Key findings

The impacts of the pandemic: exacerbating existing inequality and misinformation concerns

- **Early career, those in the Global South and, to a lesser extent, women respondents were more likely to feel the pandemic exacerbated inequalities in access to funding and resources.** The researchers we surveyed and spoke to expressed concerns about the pandemic exacerbating inequalities around access to resources and funding, and in turn the widening of pre-existing gaps^{2,3} between researchers in the Global South and the Global North. Similarly, the results of our survey indicate that more women than men and more early-career researchers than distinguished researchers were worried that the pandemic exacerbated inequalities in their field with respect to funding and access to resources (50% versus 43%, and 48% versus 37%). For these researchers, confidence in research is diminished if they are unable to access the funds and resources to conduct and publish their research.
- **Misinformation⁴ was cited as a growing concern, underscoring the importance of peer review and transparent study**

¹ In our survey, we defined early-career researchers as "undertaking a PhD", "Post-Doc" or "tenure track professor"; established researchers as "assistant professor", "professor", "senior lecturer" or "reader"; and distinguished researchers as "research group leader", "department head or chair", "tenured" or "emeritus professor".

² Ciocca DR & Delgado G. (2017). The reality of scientific research in Latin America; an insider's perspective. *Cell Stress Chaperones*, 22(6):847-852.

³ Okoduwa, SIR et al. (2018). Attitudes, Perceptions, and Barriers to Research and Publishing Among Research and Teaching Staff in a Nigerian Research Institute. *Frontiers in Research Metrics and Analytics*, 3(26).

⁴ Our survey focuses on misinformation, which should not be confused with disinformation. Misinformation involves false information that is not disseminated deliberately, while disinformation involves information that is deliberately spread with the intent to deceive.

design as markers of confidence. 69% of respondents say that the pandemic increased the importance of separating quality research from misinformation, and 78% agree it increased the importance of science bodies and researchers in explaining research findings to the public. Within this context, peer review and study design are still important factors that give respondents (74% and 66% respectively) the confidence to cite another piece of research.

- **Concern about misinformation may also be affecting how some researchers perceive their primary role in society.** Researchers in our survey still feel that their role in society mainly involves “educating others” within their field and “enabling innovation”, but since the pandemic, just under a quarter of respondents (23%) see publicly countering false or misleading information as one of their primary roles in society, compared with 16% who selected this as such before the pandemic.

Conducting research in public view: a more public-facing researcher

- **The majority of respondents feel the pandemic has increased public attention on research, but fewer think that public understanding of research will be a legacy of the pandemic.** Nearly two thirds (63%) of our survey respondents feel that the pandemic has increased public attention and scrutiny on research, but 38% believe that improved public understanding of how research is conducted will be a legacy of the pandemic. For participants in the roundtables and qualitative interviews, this gap highlighted challenges of publishing research

earlier and more transparently, as well as the difficulties associated with communicating the uncertainty of research.

- **Public attention and concerns about misinformation may be leading researchers to adopt more careful research practices and rethink what topics they focus on.**

Researchers we spoke to were generally optimistic that increased public attention on research would lead to better quality research and better research practices. 57% of respondents to our survey say that the experience of the pandemic has made them more inclined to ensure their work is peer reviewed, 48% say they are more likely to communicate uncertainties and caveats, and 47% say they are more inclined to select research topics that align with the public interest. But whether they are in fact changing their behaviour requires further investigation.

- **A more public-facing role for researchers comes with trade-offs: opportunities for public involvement, policy influence and improving social outcomes are coming up against oversimplification and politicisation of research.** Though researchers surveyed are excited about the prospects for more public involvement, and opportunities to influence both policy and social outcomes, more than half (52% and 56% respectively) remain concerned about the challenges of oversimplification and politicisation of research.

Confidence boost: supporting researchers to take on a more public role

- **Survey respondents think that personal connections are a greater determinant of whether research is used by policymakers⁵ than the substance of the research itself.**

⁵ In our survey questionnaire, policymakers were defined using the following examples: “government ministers or representatives from international organisations like the UN”.

In an ideal world, the most careful, high-quality research would make its way into policy. In reality, at least in the minds of researchers we surveyed, other factors are seen as more important. When asked about the main factors they feel affect policymaker uptake of research, just under half (49%) of researchers surveyed believe that personal connections drive uptake, compared with less than a third (29%) who feel that policymakers look at the quality of study design. In light of this, the majority of researchers surveyed (57%) are calling for more engagement opportunities with policymakers, but it needs to be easier for policymakers to find the right and best research, too.

- **A third of respondents to our survey reported that they or a close colleague have experienced abusive or acrimonious communications when engaging online or on social media.** The majority (69%) of these interactions took place on public platforms. The former figure rises to 44% amongst respondents in the US. As engaging on social media is becoming more important for researchers to share their research, advance their career and influence policymakers, researchers need support navigating online environments.
- **Opportunities for policymaker engagement, communication support and incentive reforms appear important for reaping the benefits of increased public attention without undermining confidence in research.** While more than half (55%) of researchers report having a lot of confidence in their abilities to design replicable research methods, less than one-in-five (18%) report the same degree of confidence in their ability to communicate findings via social media. But not all researchers want to or should be communicators. As researchers learn to engage with the general public, policymakers, the media and corporations, and better communicate the nuances of research, researchers we engaged with are calling on institutions to support researchers to communicate their research, and reward researchers for developing these skills.

Key takeaways and areas for action

Following a series of in-depth interviews undertaken by Economist Impact, and six in-country roundtable discussions and a Global Expert Panel that we observed, our research identified the following interventions for the research community: universities, funders, publishers, media outlets, policymakers and researchers themselves.

1. **Addressing misinformation:**

- **Campaigns to counter misinformation:** researchers we spoke to are calling for the research community to collaborate with social media platforms and policymakers to limit the spread of misinformation, and conduct more specific research on the specific elements of social media that have been most beneficial to countering misinformation.
- **Recognising peer review contributions:** The peer review process is and will continue to be key as the volume of information increases and concerns around misinformation grow. Researchers in our study are calling on universities, publishers and funders to better reward their contributions as peer reviewers when assessing career progression.

2. **Building public trust and understanding:**

- **Invest in public campaigns and bodies:** According to researchers we spoke with, policymakers can play an important role in facilitating greater public engagement by investing resources into public campaigns and public bodies that aim to strengthen the relationship between the public and the research community.
- **Conduct research on research communication methods:** As effective communication and public engagement become more important, researchers in our study are calling for fresh research to be done on the communication of research.
- **Promote awareness of research terminology:** The researchers we spoke to are calling on the research community to collaborate with the media, social media platforms and policymakers to promote better awareness of common research terminology.

- **Value interdisciplinary approaches, but be mindful of expertise:** Researchers in our study emphasised the importance of researchers embracing cross-disciplinary collaboration, but stressed the importance of humility.

- **Spotlight the societal impact of research:** Researchers we spoke to suggest that publishers integrate digestible summaries of how the research contributed to or intends to contribute to broader public impacts within or in addition to article abstracts.

3. **Preparing researchers for a more public-facing role:**

- **More time, less admin:** with more demands being placed on researchers, time is a key barrier to public engagement. Researchers we spoke with are calling on universities to simplify administrative procedures, where possible, by delegating some responsibilities to dedicated individuals or administrative staff.
- **Mentorship for early-career researchers:** Mentorship relationships were impacted during the pandemic. These networks need to be rebuilt so that early-career researchers can seek advice on methods, processes and difficulties. The researchers we spoke with feel that universities and more senior researchers have key roles to play in maintaining these relationships.
- **Formalise communications training:** Some researchers are calling for universities, funders and publishers to formalise communication training starting from the PhD level, to give researchers, especially early-career researchers the tools and guidance to communicate findings and uncertainty ethically and effectively. Others suggest directing training to university and journal staff to boost institutional capacity overall.

- **Establish communication intermediaries:** Researchers are calling on universities to hire formal science communicators to act as knowledge management bodies, and ensure existing bodies are better prepared for emergencies.
 - **Provide support in the face of online abuse:** Researchers in our study feel that universities should draft clear codes of conduct on how to manage online abuse, and make clear how they intend to protect and support researchers.
 - **Formalise science advisory institutions:** The researchers we spoke with are calling for efforts to establish “ad-hoc scientific committees” to continue, even into “normal” times.
4. **Tackling inequality:**
- **Incentivise cross-regional collaborations:** In light of concerns regarding “scientific nationalism”, the researchers we engaged with stressed the importance of incentivising cross-regional collaborations that value different knowledge systems through grants and funding.
 - **Make room for non-English speakers:** Research takes place in English, which risks excluding locally-specific perspectives and contributions from non-native English researchers. These researchers often face significant barriers to entry, especially in terms of publishing in reputable journals.

Introduction

The pandemic stress-tested the research community in a number of ways. It was a testament to the importance of global scientific collaboration, and the role of researchers in addressing major global problems. The research community will continue to be critical as we deal with the challenges associated with the climate crisis, economic instability, food insecurity and enduring conflicts. For this, however, they will need the public's support. Vaccine uptake, for instance, correlates with public trust: in a 2021 study on trust and vaccine confidence, researchers found that in countries where trust in science was strong to start with, people were more confident about vaccination.⁶ But public trust in science and research has always fluctuated. According to a 2020 Pew Research Center survey, for instance, a median of 36% of respondents have a lot of confidence in medical scientists to act in the interests of the public and do what is right. In the US, this figure was 38%⁷, but by 2022, the number of people with this same degree of confidence had dropped to 29%.⁸

Covid-19 polarised this even further. The rapid development, and subsequent roll-out, of Covid-19 vaccines saw some factions of the public's trust in research increase drastically. For others, however, the speed at which vaccines were developed was a cause for concern, and gave them a reason to trust the research community even less. Results from the 2021 Wellcome Global Monitor show that while overall public trust in science increased in 2020, compared with 2018, trust was lowest amongst people with less knowledge about science: just 33% of those who felt they know little or nothing about science had a lot of trust in science, compared with 69% of people who felt they had a strong understanding of science knowledge.⁹

This story is not unique to Covid-19. Efforts to undermine and take advantage of public trust through misinformation and disinformation have been prevalent for decades. Climate science, for instance, has faced systematic attempts by various actors to discredit,

⁶ Sturgis, P, Brunton-Smith, I & Jackson, J. (2021). Trust in science, social consensus and vaccine confidence. *Nat Hum Behav* 5, 1528–1534 <https://doi.org/10.1038/s41562-021-01115-7>

⁷ Funk, C et al. (2020). Science and Scientists Held in High Esteem Across Global Publics. Pew Research Center.

⁸ Kennedy, B, Tyson, A & Funk, C. (2022). Americans' Trust in Scientists, Other Groups Declines. Pew Research Center.

⁹ Wellcome. (2020). Wellcome Global Monitor 2020: Covid-19. Wellcome

deny, and misrepresent climate science since the 1990s.^{10,11} These have since been manifesting into more subtle forms of mis- and disinformation around the feasibility of mitigation and adaptation policies.¹² Similarly, outbreaks of the H1N1 Influenza virus in 2009, Ebola in 2014, and Zika in 2015-2016 were all characterised by the widespread dissemination of mis- and disinformation around the disease, prevention, transmission and treatment, potential health consequences, and risk assessments.¹³ Before that, the tobacco industry's lobbying against public health policies has been well documented, with campaigns ranging from buying scientific expertise to funding political parties to interfere with the creation of regulations.¹⁴

But for the public to have trust in research, it is also necessary to look at researchers and the research community itself. Researchers are already under immense pressure to produce research that is timely and of high calibre. At the same time, they have teaching responsibilities, conferences to attend, papers to review, funding applications to fill in, and public presences to maintain. Covid-19 seems to have accelerated some longer-term shifts in the way research is conducted and communicated, and as a result, more is being put on their plate. The pace and volume at which research is being produced has increased, thereby increasing researchers'

pressures to publish and their peer-review responsibilities.^{15,16,17,18,19,20,21} At the same time, with so much research out there, it is becoming more difficult to differentiate good-quality research from misinformation, leading to a greater sense of responsibility to counter misinformation from both the general public, media and policymakers, and at times the research community itself.

In this context, how confident do researchers feel in themselves and in their community to deliver research that is worthy of the public's trust? And how supported do they feel by one another to meet the new demands associated with the practice of research? The research community's confidence in relation to research methods and ethical research practices has been explored extensively (see References). It is clear that on the whole researchers feel equipped with the core skill sets. But the pandemic increased the importance of communication skills. More than ever, researchers are being called to speak on television and radio, contribute to op-eds, and proactively post on social media. The research community was called on to defend their colleagues and peers in the face of misinformation, bullying and harassment, and speak publicly on the relevance of data for policy decisions.

¹⁰ Treen, KMD, Williams, HTP & O'Neill, SJ. (2020). Online misinformation about climate change. *WIREs Clim Change*, 11, e665. <https://doi.org/10.1002/wcc.665>

¹¹ Cook, J. (2016). A brief history of fossil-fuelled climate denial. *The Conversation*.

¹² What is climate disinformation? (2022). *Global Witness*

¹³ Chowdhury, N, Khalid, A & Turin, TC. (2021). Understanding misinformation infodemic during public health emergencies due to large-scale disease outbreaks: a rapid review. *J Public Health (Berl.)*, <https://doi.org/10.1007/s10389-021-01565-3>

¹⁴ Saloojee, Y & Dagli, E. (2000). Tobacco industry tactics for resisting public policy on health. *Bulletin of the World Health Organization*, 78, 902-910.

¹⁵ Elsevier and Sense about Science. (2019). Quality, trust & peer review: researchers' perspectives 10 years on.

¹⁶ Buljan, I, Barać, L & Marušić, A. (2018). How researchers perceive research misconduct in biomedicine and how they would prevent it: A qualitative study in a small scientific community. *Account Res*, 25(4), 220-238.

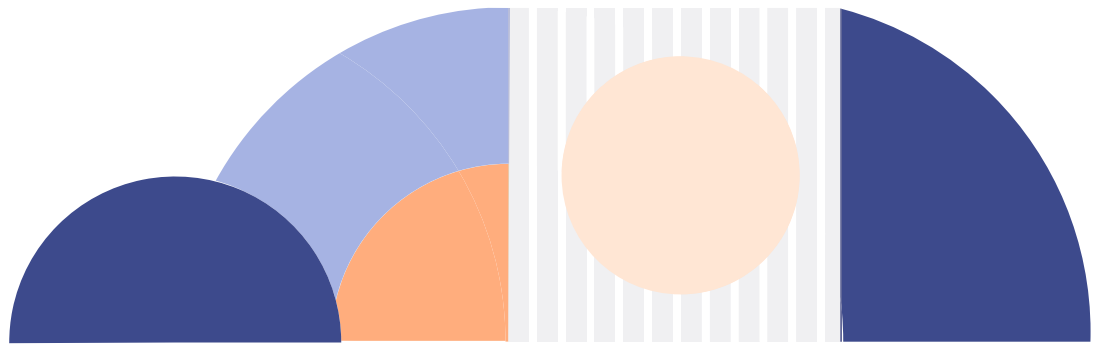
¹⁷ Moher, D et al. (2020). The Hong Kong Principles for assessing researchers: Fostering research integrity. *PLoS Biol*, 18(7), e3000737.

¹⁸ Bello, M & Galindo-Rueda, F. (2020). Charting the digital transformation of science: Findings from the 2018 OECD International Survey of Scientific Authors (ISSA2). OECD Science, Technology and Industry Working Papers, 2020/03. OECD Publishing, Paris

¹⁹ Morens, D & Hammatt, Z. (2021). The COVID-19 pandemic: some thoughts on integrity in research and communication. *Forensic Sciences Research*, 1-6.

²⁰ Else, H. (2020). How a torrent of COVID science changed research publishing — in seven charts. *Nature*, 588, 553

²¹ Dinis-Oliveira, RJ. (2020). COVID-19 research: pandemic versus "paperdemic", integrity, values and risks of the "speed science". *Forensic Sciences Research*, 5(2), 174-187.



Our study seeks to identify actionable insights and interventions for the research community to take forward to bolster scientific practice and confidence in research. We elaborate on this in the methodology chapter that follows, but for more detail, refer to the technical appendix at the end of the report.

The findings of our research have been broken down into four key sections.

First, the impacts of the pandemic, where we explore the disproportionate impacts on women, researchers in the Global South, and early-career researchers. Here, we also uncover the growing challenges and concerns associated with misinformation and the need to disentangle this from good-quality information. In this context, the report looks at the factors that give researchers themselves the confidence to distinguish between the two, especially as the importance of publishing research quickly becomes more apparent, and examines how this might be affecting how researchers view their primary roles in society.

Second, we dive into a specific outcome of the pandemic: conducting research in the public view. In this section, we discuss the gap between public attention on research and public understanding of research; how respondents might be adjusting their behaviours in light of this; and the trade-offs associated with increased public attention.

Third, we speak to what is needed to boost researcher confidence. More specifically, we highlight the increased demand for public communication; the degree to which researchers feel equipped and willing to fill this demand; the need for better communication models; and the targeted support that researchers are calling for.

Finally, we elaborate the key recommendations and takeaways that emerged from our roundtable discussions and interviews aimed at tackling inequalities within the research community; addressing misinformation; preparing researchers for a more public-facing role; and building public trust and understanding of the research process.

Research methodology

Economist Impact's research is based on a rapid pragmatic literature review, a survey of 3,144 researchers globally and just under a dozen in-depth interviews. We convened an independent Advisory Board to provide advice and critique at key moments in the research. And we observed, and included insights from, six regional roundtables that were organised by Elsevier's regional convening partners with researchers in China, Germany, Japan, Netherlands, the UK and US. Here, we provide a high-level summary of our research approach. A detailed methodology note is included in the Technical Appendix to this report.

We commenced the research with a rapid, pragmatic literature review with articles limited to the English language and published in the last five years. Using various permutations of search terms around 'confidence in research', 'research integrity', and 'scientists trust', among others, our search produced 5,957 results of which 1,553 were duplicates. An initial review at title and abstract level resulted in 361 relevant references, of which 204 were included in our review. The results were analysed along four domains and written up into a 17,000-word review. Based on the themes identified in the literature review, we produced a thematic framework to inform the survey questionnaire design. Our aim was to focus the survey on areas that had received less attention in past research. This led us away from issues of research integrity, which are extremely important but well covered, and towards an exploration of the effect of increased public attention on research and its impact.

Based on our literature review, we drafted a survey questionnaire that was circulated to members of our Global Advisory Board (see About the Research for the full list of members). We then convened our Advisory Board for a three-hour meeting in March 2022 where we received their feedback. Following this feedback, we produced further iterations of the survey questionnaire that were circulated to the Advisory Board for their reference. The survey was finalised in May 2022 and fielded between 17 May 2022 and 19 July 2022.

To disseminate the survey, we used Elsevier's Scopus database of over 17 million authors published in over 42,000 titles from over 7,000 publishers. Our survey was sent to a random sample drawn from 5.6 million researchers who had published an article within the past three years.^{22,23} We also included a screener question to ensure respondents were still active in research. Over the course of

²² 90% of these titles are not Elsevier titles, and content indexed in the Scopus database is selected by the independent Scopus Content Selection and Advisory Board (CSAB).

²³ <https://www.elsevier.com/solutions/scopus/how-scopus-works/content>, Titles on Scopus downloadable list as of August 2022, excluding titles discontinued by Scopus. Scopus is updated daily, and the exact numbers may slightly differ at the time of drawing the sample or the time of reading (please refer to the site for the latest figures).

10 weeks, we exceeded our target sample size of 3,000 with a total of 3,144 completed surveys. The survey was disseminated in English and Mandarin. As such, results may also be subject to language biases, especially in countries where English is not a first language. To improve the representativeness of our sample, we weighted responses at the regional level against data on researchers per million inhabitants (full-time equivalent) from the UNESCO Institute for Statistics (UIS) database on the global researcher population.²⁴ Base sizes included in the report are unweighted unless otherwise stated. The exception here is data at the regional level, where assessments took place using weighted data to facilitate more representative comparisons across regions.



It is important to stress that our results should be seen as indicative rather than representative of global, regional or national research populations. Nevertheless, the findings generally resonated with the researchers we engaged with in roundtable discussions and interviews. We hope that they can serve as a basis for further research and productive discussions between researchers and those within the broader research community.

Further details about the research methodology, including the demographic breakdown of survey respondents, is included in the Technical Appendix to this report.

²⁴UNESCO Institute for Statistics (2022). <http://data.uis.unesco.org/>

Findings



The impacts of the pandemic: exacerbating existing inequality and misinformation concerns

The pandemic accelerated some longer-term shifts in the ways in which researchers collaborate, conduct and communicate the practice of science. Most notably, it shone a spotlight on science and research. In 2016, the UK saw policymakers claiming that people had “enough of experts”²⁵; the US saw Donald Trump accuse scientists of being in on the climate “hoax”²⁶; in Latin America, Mexican President López Obrador and his Brazilian counterpart, Bolsonaro, spent a good part of the beginning of the pandemic minimising the dangers of Covid-19, despite scientific evidence.²⁷ In sharp contrast, scientists and researchers returned to the public eye in 2020. They guided and communicated policy decisions, reassured the general public of science-backed vaccine deployment and countered vaccine hesitancy. It seemed that the pandemic increased public attention and scrutiny on the research community in ways that haven’t previously been experienced, given the global scale of the pandemic and the ubiquity of social media. We wanted to use our survey to test the assumption

that the pandemic increased public attention on research. And **nearly two thirds of the researchers we surveyed (63%) believe that the pandemic has increased public attention and scrutiny on research in general.**

The effects of this have been both positive and negative for science and academic research more broadly. As researchers and their research took centre stage, so too did incentives for cross-disciplinary and cross-border collaboration to produce results and solutions. The rapid development of vaccines was a huge success for the research community in this regard. Vaccine development timelines went from 10 years under normal circumstances to less than 12 months during the pandemic.²⁸ The development of mRNA-1273 vaccines, for instance, though underpinned by decades of consistent research²⁹, involved a collaboration between Moderna Therapeutics (US) and the National Institute of Allergy and Infectious Diseases (NIAID), and testing took place within a span of nine months: between March

²⁵ Mance, H. (2016, June 3). Britain has had enough of experts, says Gove. *Financial Times*.

²⁶ Schulman, J. (2018, December 12). Every Insane Thing Donald Trump Has Said About Global Warming. *Mother Jones*.

²⁷ Felbab-Brown, V. (2020). AMLO’s feeble response to COVID-19 in Mexico. *The Brookings Institution*; Saad Filho, A. & Feil, F. (2021). COVID-19 in Brazil: how Jair Bolsonaro created a calamity. *King’s College London*.

²⁸ Broom, D. (2020) *5 charts that tell the story of vaccines today*. *World Economic Forum*.

²⁹ Evans, Ian. (2021, July 22). Behind the scenes of developing Pfizer’s Covid vaccine. *Elsevier*.

2020, when the first shot was delivered, and December 2020, when the US Food and Drug Administration (FDA) approved it for emergency use.³⁰ Meanwhile, the development of the Comirnaty (mRNA-BNT162b2) vaccines involved a collaboration between Pfizer, BioNTech (Germany), and Fosun Pharma (China), and the Phase III trial was complete within five months: from July 2020 until December 2020, when it was approved for emergency use by the FDA.^{31,32}

Indeed, as researchers reflect on the pandemic, our results show that just under two thirds of respondents (64%) think the community responded well to the challenges of the pandemic. But this came with disproportionate impacts on some researcher groups, and the dissemination of false or misleading information, all of which have implications for researchers' confidence in themselves and their community.

The disproportionate impacts of pandemic

The pandemic affected researchers differently. More specifically, for women, researchers in the Global South and early-career researchers, the increasingly fast-paced demands of research added to pre-existing challenges that the pandemic exacerbated.

Early assessments on the impacts on women point to a mixed picture: an analysis of articles published in Elsevier's *Brain, Behaviour and Immunity* (BBI) journal suggests that women researchers had more difficulties publishing

their research in the wake of Covid-19. Their analysis showed that there were fewer female first and last authors in the July, August and October 2020 volumes (32% and 20%)—which contained a high proportion of Covid-19 special-issue articles—than in the July, August, October and November volumes of 2019 (62% and 42%).³³ Our results also indicate greater concerns regarding funding and resources: in our survey, more women than men were worried that the pandemic exacerbated inequalities in their field with respect to funding and access to resources (50% vs 43%). Conversely, an assessment of 266,409 articles from the Springer-Nature database of 2813 journals across 21 disciplines found no difference in publication numbers between men and women since the onset of the pandemic, with the exception of psychology, mathematics and philosophy.³⁴ Similarly, a 2020 survey by the UK Department for Business, Energy & Industrial Strategy (BEIS) found that the impacts on research capacity and publications were a product of caring responsibilities, irrespective of gender.³⁵

That said, the full effects of this are yet to be seen, as publication data for 2021 and 2022 are not entirely reflective of the impacts of the pandemic in the long term. In that vein, according to Dr Ayesha Siddiqi, lecturer at the Department of Geography at University of Cambridge and member of the Arts and Humanities Research Council (AHRC), "on emergency management, the research community was inclusive in holding onto funds and allowing for delays, but in the long-term

³⁰ Clifford, C. (2021, July 3). How Moderna Covid-19 mRNA vaccine was made so quickly. CNBC.


³¹ Kyriakidis, NC et al. (2021). SARS-CoV-2 vaccines strategies: a comprehensive review of phase 3 candidates. *npj Vaccines* 6, 28. <https://doi.org/10.1038/s41541-021-00292-w>

³² About our landmark trial. (nd). Pfizer

³³ Ribarovska AK et al. (2021). Gender inequality in publishing during the COVID-19 pandemic. *Brain Behav Immun*. 91, 1-3. doi: 10.1016/j.bbi.2020.11.022.

³⁴ Jemielniak, D, Sławska, A & Wilamowski, M. (2022). COVID-19 effect on the gender gap in academic publishing. *Journal of Information Science*, p.016555152110681.

³⁵ Department for Business, Energy & Industrial Strategy & Vitae (2020). The impact of the Covid-19 pandemic on researchers in universities and research institutes. UK Government. <https://www.vitae.ac.uk/impact-and-evaluation/covid-19-impact-on-researchers>



“I don’t think there is a framework in place to understand [and account for] the long-term impacts of the pandemic on women with caring responsibilities, researchers from immigrant backgrounds or researchers in the Global South.”

Dr Ayesha Siddiqi, lecturer at the Department of Geography at University of Cambridge and member of the Arts and Humanities Research Council (AHRC)

this will fade and disproportionately impact particularly minority groups. I don’t think there is a framework in place to understand [and account for] the long-term impacts of the pandemic on women with caring responsibilities, researchers from immigrant backgrounds or researchers in the Global South”.

The pandemic also had a disproportionate effect on researchers in the Global South, exacerbating pre-existing global knowledge inequities. For many researchers working in countries across Africa, Latin America and Asia, access to resources was already an issue before the pandemic. For instance, in a 2018 survey of 130 Nigerian researchers and research staff, 57% of survey participants had never had a single paper published, and cited no writing experience (96%), high publishing fees (80%), long waiting periods for peer review (97%), the provision of research grants/funds (93%), and the provision of internet facilities (95%) as key reasons for this.³⁶

Similarly, in a 2017 assessment of scientific research in Latin America, the factors

associated with low research productivity were limited access to grant opportunities, inadequate budgets, high costs and limited supply of laboratory infrastructure and equipment, inadequate salaries and personal insecurity of scientists. This made science and research as a career prospect less appealing for young scientists, making it even more difficult to further the practice of science within the region.³⁷

These challenges have worsened since the pandemic, with national lockdowns affecting access to labs, equipment, resources and funding.³⁸ “The pandemic made researching very difficult. Lockdowns, restrictions on movement and no in-person interactions meant that scholars and researchers could not go to university to access data, subscriptions or even get internet access to do their work. And internet access is not a luxury that most research communities (in this case in East Africa) have. Some universities stopped being able to afford subscriptions and many almost went bankrupt”, says Dr Job Mwaura, Research Fellow at Stellenbosch University in South Africa.

³⁶Okoduwa, SIR et al. (2018). Attitudes, Perceptions, and Barriers to Research and Publishing Among Research and Teaching Staff in a Nigerian Research Institute. *Frontiers in Research Metrics and Analytics*, 3(26).

³⁷Ciocca DR, Delgado G. (2017). The reality of scientific research in Latin America; an insider’s perspective. *Cell Stress Chaperones*. 22(6), 847-852.

³⁸Forti, LR, Solino, LA & Szabo, JK. (2021). Trade-off between urgency and reduced editorial capacity affect publication speed in ecological and medical journals during 2020. *Humanit Soc Sci Commun* 8, 234; Parmar, A. (2020). Panic publishing: An unwarranted consequence of the COVID-19 pandemic. *Psychiatry Res*. 294, 113525.

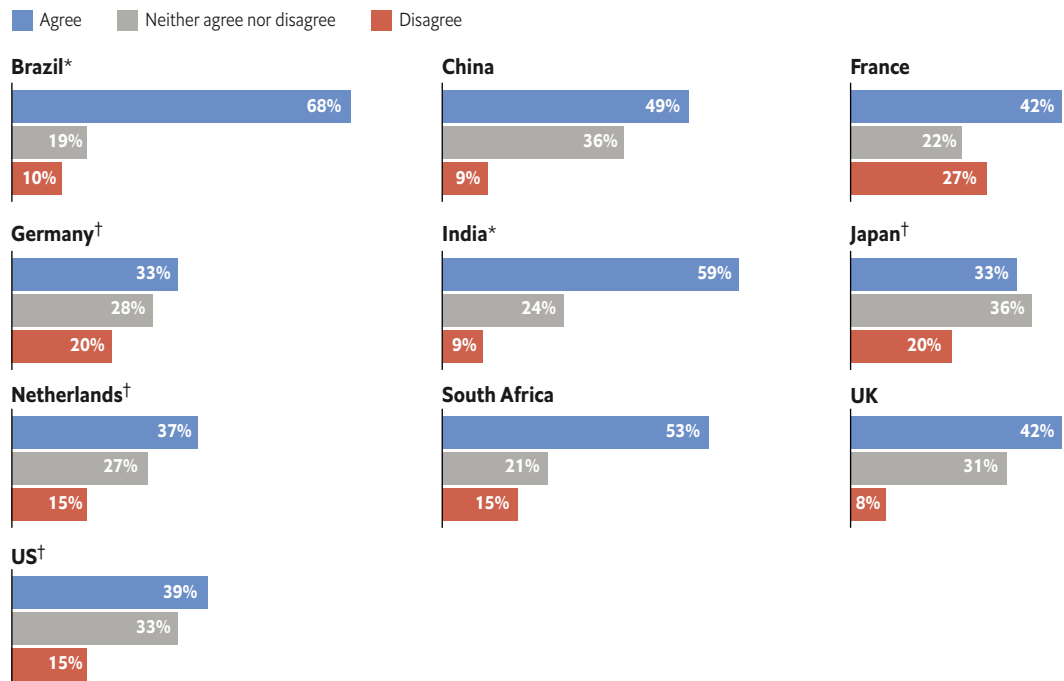
Supply-chain disruptions were also felt more acutely for researchers in the Global South.³⁹ Dr Sarah Iqbal, Science engagement consultant, Foundation for Advancing Science and Technology (FAST India), says that in India, the pandemic added additional burdens relating to access to resources. “Just like in the UK, Indian researchers now face hypercompetition for funding to keep our labs afloat. But unlike the UK, Indian researchers spend a lot of time doing admin work to sort out supply-chain issues. Sometimes, I wait for weeks to get materials or supplies, as these tend to come from abroad as there is no infrastructure capacity to produce some of these things domestically. In that sense, researchers in India need to plan alongside when they will get their equipment, we need to be adaptable, and this slows the work down

and makes it difficult to produce research at the speed we are increasingly asked to produce it”, she explains. Indeed, our research indicates that concerns around the exacerbated inequalities were felt the most amongst researchers in the Global South, compared with their counterparts in the Global North. In Brazil, for instance, 68% of respondents are concerned that the pandemic worsened inequalities around access to funding and resources, compared with just 33% of respondents in Germany (see Figure 1).

A similar logic applies to early-career researchers. The uncertainty associated with lockdowns, and more recently, the hybrid new normal, has left some feeling burnt out and unmotivated, prompting them to reconsider the feasibility of their career in academia, according to the

Figure 1: Concerns around funding and resource inequalities by country

Percentage of respondents selecting agree - disagree to the following statement “the pandemic exacerbated inequalities in terms of access to funding and resources for research in my field”.



Note: Sample size (N), weighted: Brazil (N=91), China (N=374), France (N=36), Germany (N=178), India (N=243), Japan (N=333), Netherlands (N=202), South Africa (N=73), UK (N=235), US (N=724)
 Significant differences (at 95% confidence levels) when comparing the sub-group against the overall mean (% selecting agree). An Asterisk (*) indicates the subgroup result is higher than the overall mean while a Dagger (†) indicates it's lower.

³⁹Ciocca DR & Delgado G. (2017). The reality of scientific research in Latin America; an insider’s perspective. *Cell Stress Chaperones*. 22(6), 847-852.



48% vs 39%

In our survey, early-career researchers we surveyed felt that the pandemic had exacerbated funding and resource inequalities, with 48% agreeing with this statement, compared with 39% of distinguished researchers

longitudinal Harbingers 2 project.⁴⁰ Here, country differences stemmed from the degree to which researchers perceived there to be structural issues with academia, too.⁴¹ Similarly, assessments by the Global Young Academy concluded that the socio-economic consequences of the pandemic added to existing worries amongst early-career researchers, leaving many with increased job insecurity.⁴² Finally, a *Nature* survey of over 7600 postdoctoral researchers from June to July 2020 found that 61% of respondents felt the pandemic had negatively affected their career prospects, with 13% losing a postdoc or post-postdoc job offer because of Covid-19 and a further 21% unsure if that was the reason for the withdrawal.⁴³

In this context, it is no surprise that the early-career researchers we surveyed felt that the pandemic had exacerbated funding and resource inequalities, with 48% agreeing with this statement, compared with 39% of distinguished researchers.

Dr Alejandro Miranda-Nieto, Postdoctoral Fellow, Faculty of Social Sciences, Department of Social Work, Child Welfare and Social Policy, Living Conditions, Health, Work and Social Inequalities, OsloMet and one of the authors of Global Young Academy's research in Latin America, explains

that “the main preoccupation of early-career researchers is not if research works well [in terms of research integrity] or not. They trust the research system and they know it works. But many view it as a hypercompetitive environment where they struggle to keep afloat. Because of this, their preoccupations are less on the impacts of science, and more the stability and improvement of their careers”. The pandemic exacerbated this. “Those who already had an ongoing position, which were the minority of the early-career researchers we spoke to, had to adapt and find ways to continue their research. Those that were in precarious positions, on the other hand, were under extreme pressure to develop their profiles, connect with people, and maintain their networks”, he says. These issues were even more pronounced in regions like Latin America, where funding gaps and inequalities already existed. As a result, for researchers disproportionately impacted by the pandemic, confidence in research will depend heavily on the research community's ability to take these impacts into account both in the short and long term.

Mis-infodemic: Growing concerns about misinformation

Across the board, however, many researchers are coming out of the pandemic with greater concerns around the spread of misinformation.⁴⁴

Covid-19 saw widespread misinformation disseminate across traditional media, social media and even in policy circles, prompting efforts from the likes of the World Health

⁴⁰ Abdullah, A et al. (2021). Harbingers-2: Taking The Pulse One Year On. University of Tennessee Knoxville/CIBER Research. Available from http://ciber-research.com/download/20211204-Harbingers2_Taking%20the%20pulse%20one%20year%20on.pdf

⁴¹ Ibid

⁴² Miranda-Nieto, A et al. (2021). Reviewing research on researchers: Our knowledge of early-career researchers in Latin America and the Caribbean. Global Young Academy

⁴³ Woolston, C. (2020). Pandemic darkens postdocs' work and career hopes. *Nature*, 585(7824), 309-312.

⁴⁴ Love, JS, Blumenberg, A & Horowitz, Z. (2020). The Parallel Pandemic: Medical Misinformation and COVID-19. *J Gen Intern Med* 35, 2435-2436; Moran, P. (2020). Social Media: A Pandemic of Misinformation. *Am J Med*. 133(11):1247-1248; Prasad, A. (2022). Anti-science Misinformation and Conspiracies: COVID-19, Post-truth, and Science & Technology Studies (STS). *Science, Technology and Society*, 27(1), 88-112.

“The main preoccupation of early-career researchers is not if research works well [in terms of research integrity] or not. They trust the research system and they know it works. But many view it as a hypercompetitive environment where they struggle to keep afloat.”

Dr Alejandro Miranda-Nieto, Postdoctoral Fellow, Faculty of Social Sciences, Department of Social Work, Child Welfare and Social Policy, Living Conditions, Health, Work and Social Inequalities, OsloMet and one of the authors of Global Young Academy’s research in Latin America

Organisation (WHO) to “stop the spread”.⁴⁵ Indeed, over two thirds (69%) of participants in our survey say the pandemic has increased the importance of separating quality research from misinformation. Our survey also suggests that researchers are increasingly seeing it as part of the research community’s role to bring clarity and counter misinformation in the public sphere.

Almost four-in-five researchers surveyed (78%) believe that the pandemic increased the importance of science bodies and researchers in explaining research findings to the public. These views were shared amongst researchers across fields of expertise, but were slightly more acute for researchers working in health-related fields, who were perhaps closer to questions around vaccine hesitancy.

There are also differences across countries and regions (see Figure 2). Many respondents (84%) in Latin America believe that the pandemic has increased the importance of separating quality research from misinformation compared with just over half (59%) of respondents in the Asia-Pacific region (APAC). Concerns around misinformation in Latin America may stem from the fact that the region falls behind in providing reliable information on science and scientific research through their media, according to Dr Jose Mustre de Leon, director general of the Centre for Research and Advanced Studies (Cinvestav), Mexico. “The media in Mexico does not act as a filter for countering false information and ensuring confidence in research. This is not because of a deliberate attitude but because the professional formation of communicators, with a background in science, is not very well developed”, he explains.

69%

Over two thirds (69%) of participants in our survey say the pandemic has increased the importance of separating quality research from misinformation

78%

Almost four-in-five researchers surveyed (78%) believe that the pandemic increased the importance of science bodies and researchers in explaining research findings to the public

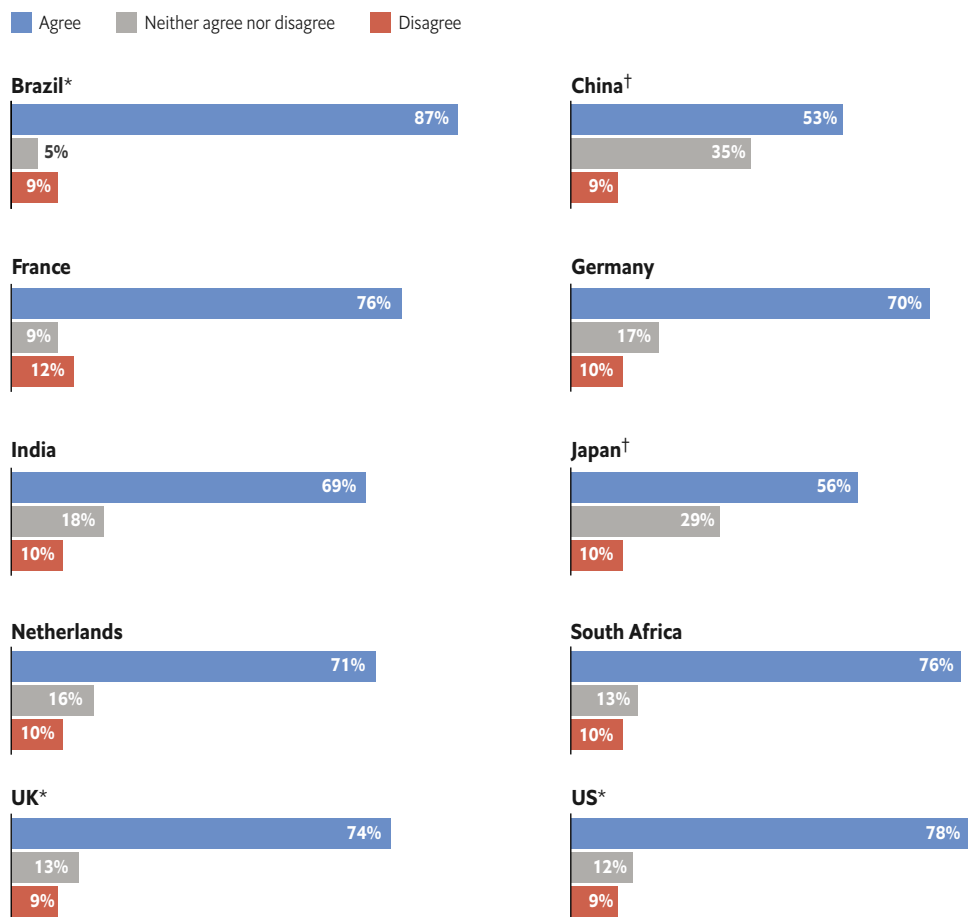
⁴⁵ World Health Organisation (2021). Reviewing research on researchers: Our knowledge of early-career researchers in Latin America and the Caribbean. United Nations.

Adding to this, Dr Miranda-Nieto explains that institutional strength and capacity matters a lot in determining a country’s challenges with misinformation. “You have Brazil, a major player in science, and they have good infrastructure in scientific development and communication. It’s much more institutionalised than a place like

Panama, which is much smaller in the scientific community. Even if they are doing great work to try to communicate science, they face structural issues and chronic underfunding. So their capacity to reach audiences [and in turn counter misinformation] is much more limited.”

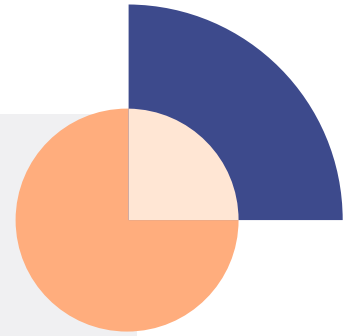
Figure 2: Country-level variations in concerns around misinformation

Percentage of respondents who selected agree - disagree to the following statement “The pandemic increased the importance of separating good quality research from misinformation.”



Note: Sample size (N), weighted: Brazil (N=91), China (N=374), France (N=36), Germany (N=178), India (N=243), Japan (N=333), Netherlands (N=202), South Africa (N=73), UK (N=235), US (N=724)
 Significant differences (at 95% confidence levels) when comparing the sub-group against the overall mean (% selecting agree). An Asterisk (*) indicates the subgroup result is higher than the overall mean while a Dagger (†) indicates it's lower.

Our results reaffirmed that researchers across regions, career stages and disciplines value the peer-review process, design of the research methodology and, to a lesser extent, the degree to which it has been cited by other researchers and the accessibility of data.



The basis of researcher confidence

In this context, how do researchers themselves separate quality information from misinformation? Our literature review identified that peer review, research methods, research records and the reporting of irresponsible research practices and conflicts of interest are important elements of confidence in research.^{46,47} Despite this, issues relating to misconduct^{48,49,50,51,52} publication and citation bias^{53,54,55} retractions,^{56,57} and publication manipulation⁵⁸ remain prevalent. Researchers globally are already under immense pressure to publish their research in reputable journals.^{59,60,61,62,63} The pandemic added to this, with scientific methods, tools and processes put under pressure as decision makers and the

public demanded quicker answers to pressing questions.⁶⁴ **Our results reflect this: just over half of researchers surveyed (52%) across disciplines agreed that the pandemic increased the importance of making research available quickly as preprints before peer review.**⁶⁵ While this allowed researchers to provide important answers quickly, the benefits of publishing early are not a guarantee. Indeed, participants of the Japanese roundtable argued that the pandemic re-introduced the need for “slow science” to mitigate against the large volume of information and the recent wave of “fast science”. In this context, they noted that some areas of research—such as fast-moving developments around AI—may be better suited to this “fast science” than others.

⁴⁶ Huybers, T, Greene, B & Rohr, DH. (2020). Academic research integrity: Exploring researchers' perceptions of responsibilities and enablers. *Account Res*, 27(3), 146-177.

⁴⁷ Elsevier and Sense about Science. (2019). Quality, trust & peer review: researchers' perspectives 10 years on.

⁴⁸ Li, D & Cornelis, G. (2020). Defining and Handling Research Misconduct: A Comparison Between Chinese and European Institutional Policies. *J Empir Res Hum Res Ethics*, 15(4), 302-319.

⁴⁹ Li, D & Cornelis, G. (2021). Differing perceptions concerning research misconduct between China and Flanders: A qualitative study. *Account Res*, 28(2), 63-94.

⁵⁰ Tang, L. (2020). Five ways China must cultivate research integrity. *Nature*, 575(7784), 589-591.

⁵¹ Sharma, H & Verma, S. (2020). Insight into modern-day plagiarism: The science of pseudo research. *Tzu Chi Medical Journal*, 32(3), 240-244.

⁵² Akbari, A. (2021). Spinning-translation and the act of plagiarising: how to avoid and resist. *Journal of Further and Higher Education*, 45(1), 49-64.

⁵³ Mlinaric, A, Horvat, M & Smolcic, VS. (2017). Dealing with the positive publication bias: Why you should really publish your negative results. *Biochemia Medica*, 27(3), 030201.

⁵⁴ Casadevall, A et al. (2016). A framework for improving the quality of research in the biological sciences. *mBio*, 7(4), e01256-16.

⁵⁵ Buruk, B, Ekmekci, PE & Arda, B. (2021). Research and randomized clinical trials during the covid-19 pandemic: Could ethics guide us? *Medicine and Law*, 40(2), 181-198.

⁵⁶ Goldberg, AC et al. (2019). Scientific integrity 2.0: misconduct. Let's prevent, not punish! *Einstein (Sao Paulo)*, 17(4), eED5064.

⁵⁷ D'Souza, DM, Sade, RM & Moffatt-Bruce, SD. (2020). The many facets of research integrity: What can we do to ensure it? *The Journal of thoracic and cardiovascular surgery*, 160(3), 730-7

⁵⁸ Malički, M et al. (2020). Preprint Servers' Policies, Submission Requirements, and Transparency in Reporting and Research Integrity Recommendations. *Jama*, 324(18), 1901-1903.

⁵⁹ Moher, D et al. (2020). The Hong Kong Principles for assessing researchers: Fostering research integrity. *PLoS Biol*, 18(7), e3000737.

⁶⁰ Bello, M & Galindo-Rueda, F. (2020). Charting the digital transformation of science: Findings from the 2018 OECD International Survey of Scientific Authors (ISSA2), *OECD Science, Technology and Industry Working Papers*, 2020/03. OECD Publishing, Paris

⁶¹ Morens, D & Hammatt, Z. (2021). The COVID-19 pandemic: some thoughts on integrity in research and communication. *Forensic Sciences Research*, 1-6.

⁶² Else, H. (2020). How a torrent of COVID science changed research publishing – in seven charts. *Nature*, 588, 553

⁶³ Dinis-Oliveira, RJ. (2020). COVID-19 research: pandemic versus “paperdemic”, integrity, values and risks of the “speed science”. *Forensic Sciences Research*, 5(2), 174-187.

⁶⁴ Cochrane. (2022). Cochrane Convenes: Preparing for and responding to global health emergencies. What have we learnt from COVID-19? Reflections and recommendations from the evidence synthesis community.

⁶⁵ Suart, C, Neuman, K & Truant R. (2022). The impact of the COVID-19 pandemic on perceived publication pressure among academic researchers in Canada. *PLOS ONE* 17(6): e0269743; Dinis-Oliveira, RJ. (2020). COVID-19 research: pandemic versus “paperdemic”, integrity, values and risks of the “speed science”. *Forensic Sciences Research*, 5(2), 174-187.



“Confidence in my opinion is based on the openness and documentation of research and research methods. If this has been done, researchers can follow what you’ve done and then trust is created”

Dr Hjordis Czesnick, head of office of the German Research Ombudsman

Though not equated to the issue of misinformation, there are also concerns amongst the researchers we spoke with that publishing research in preprints risks adding to public misunderstandings of research findings. Our literature review found that some researchers became concerned that the rise of preprint publications without a proper public understanding of what it entails was leading to the dissemination of “bad science”.^{66,67,68} Adding to this, predatory journals—journals that actively seek manuscripts for a fee but do not provide solid peer review or proper editorial services—have also been on the rise, worrying many researchers.^{69,70,71,72,73}

In this context, how can researchers feel confident in the research being produced, and more specifically, what affects their decision to cite someone else’s research? Our results reaffirmed that **researchers across regions, career stages and disciplines value the peer-review process, design of the research methodology and, to a lesser**

extent, the degree to which it has been cited by other researchers and the accessibility of data.

These factors also resonated with the individuals we interviewed. “Confidence in my opinion is based on the openness and documentation of research and research methods. If this has been done, researchers can follow what you’ve done and then trust is created”, says Dr Hjordis Czesnick, head of office of the German Research Ombudsman. “[When deciding whether or not to cite someone else’s work] I would look at five key things: first, I would want to see that research was preceded by some kind of systematic review to get some sense of what was known before the study. Second, I would want to know the clear rationale for why the design was chosen, as this would give me confidence that the researchers chose the right design. Third, that the basic elements of good trial conduct were followed. Fourth, that the research was sponsored by a research sponsor that I trust.

⁶⁶ Elsevier and Sense about Science. (2019). *Quality, trust & peer review: researchers’ perspectives 10 years on*.

⁶⁷ Malički, M et al. (2020). Preprint Servers’ Policies, Submission Requirements, and Transparency in Reporting and Research Integrity Recommendations. *Jama*, 324(18), 1901-1903.

⁶⁸ Jesus-Silva S & Antonio, A. (2021). Research integrity in times of pandemic. *Rev Cienc Saude*, 11, 3-5.

⁶⁹ Bucceri, A, Hornung, P & Schindler, TM. (2019). Predatory publishing – what medical communicators need to know. *Medical Writing*, 28(3), 28-33.

⁷⁰ Johal, J et al. (2017). Beware of the predatory science journal: A potential threat to the integrity of medical research. *Clinical anatomy*, 30(6), 767-773.

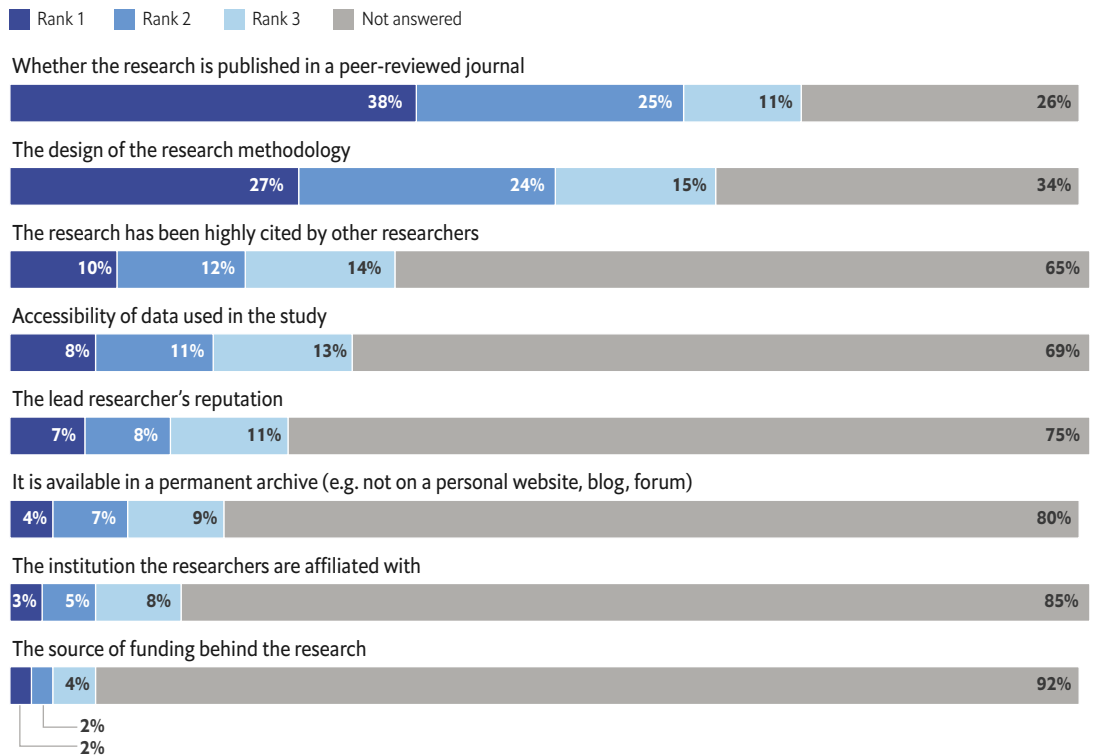
⁷¹ Rifai, N et al. (2019). Maintaining research and publication integrity. *Clinical Chemistry*, 65(2), 230-235.

⁷² Van Nuland, SE & Rogers, KA. (2017). Academic nightmares: Predatory publishing. *Anat Sci Educ*, 10(4), 392-394.

⁷³ Cortegiani, A, Manca, A & Giarratano, A. (2020). Predatory journals and conferences: why fake counts. *Curr Opin Anaesthesiol*, 33(2), 192-197.

Figure 3: Factors affecting researchers' confidence

The factors that give respondents confidence that findings are reliable when choosing to cite or share someone else's research. Ranked in order of importance.



When asked about the top three factors that give them confidence to cite another piece of research, two factors dominated: 74% selected whether the research is published in a peer-reviewed journal, 66% selected the design of the research methodology.

Note: Sample size (N), Total respondents: (N = 3144)

And fifth, that results were reported in a timely manner”, says Dr Deborah Zarin, Program Director, Advancing the Clinical Trials Enterprise at MRCT Centre of Brigham’s and Women’s Hospital and Harvard University.

New responsibilities

The pandemic may also be prompting changes in how respondents see their primary roles in society. When asked what they see as the important aspects or functions of their role—before the pandemic compared with today—researchers in our survey still feel their role mainly involves “educating others” within their field and “enabling innovation”. But since the

onset of the pandemic, our research suggests an increase in the number of researchers who want to play a bigger role in countering misinformation and in turn, engage in more public communication (see Figure 4). More specifically, nearly a quarter (23%) of our survey respondents globally now see publicly countering false or misleading information as one of their primary roles in society, up from 16% before the pandemic. For Dr Mwaura, “research is supposed to investigate an issue and produce a solution to that issue. That should be the main aim. If there is something that needs more investigation, for instance, false information, it is then the role of the researcher to come in and investigate it.”

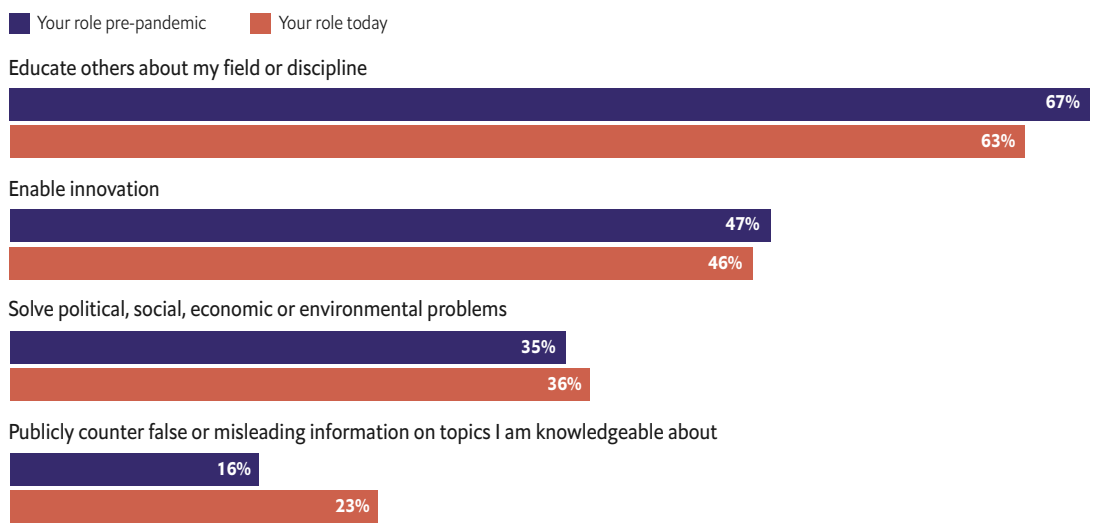
Here, there are regional and country-level differences, as well as expertise-level differences in the changing role of the researcher. Most notably, researchers in the US appear to feel these shifts more prominently. Before the pandemic, just 16% of US researchers in our survey felt that publicly countering false or misleading information was a key part of their role as researchers. This figure jumped by 11

percentage points to 27% after the pandemic (see Figure 5, and Country spotlight: The US' pronounced misinformation challenge).

Similarly, though perhaps unsurprisingly, our survey indicates that researchers who report having worked in health-related fields are also reporting a larger shift in their role with regard to countering misinformation, compared with their peers in other fields.

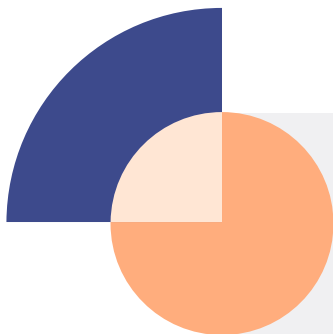
Figure 4: Shifts in researchers' self-perceived role in society

The two most important elements of respondents' role, today compared with before the pandemic (aside from generating new knowledge within a particular field or discipline).



Nearly a quarter (23%) of researchers now see publicly countering false or misleading information as part of their role, up from 16% from before the pandemic.

Note: Sample size (N), Total respondents: (N = 3144)



Perhaps unsurprisingly, our survey indicates that researchers who report having worked in health-related fields are also reporting a larger shift in their role with regard to countering misinformation, compared with their peers in other fields.

Figure 5: Changes in the primary role of researchers by country

Percentage point change today compared with before the pandemic.

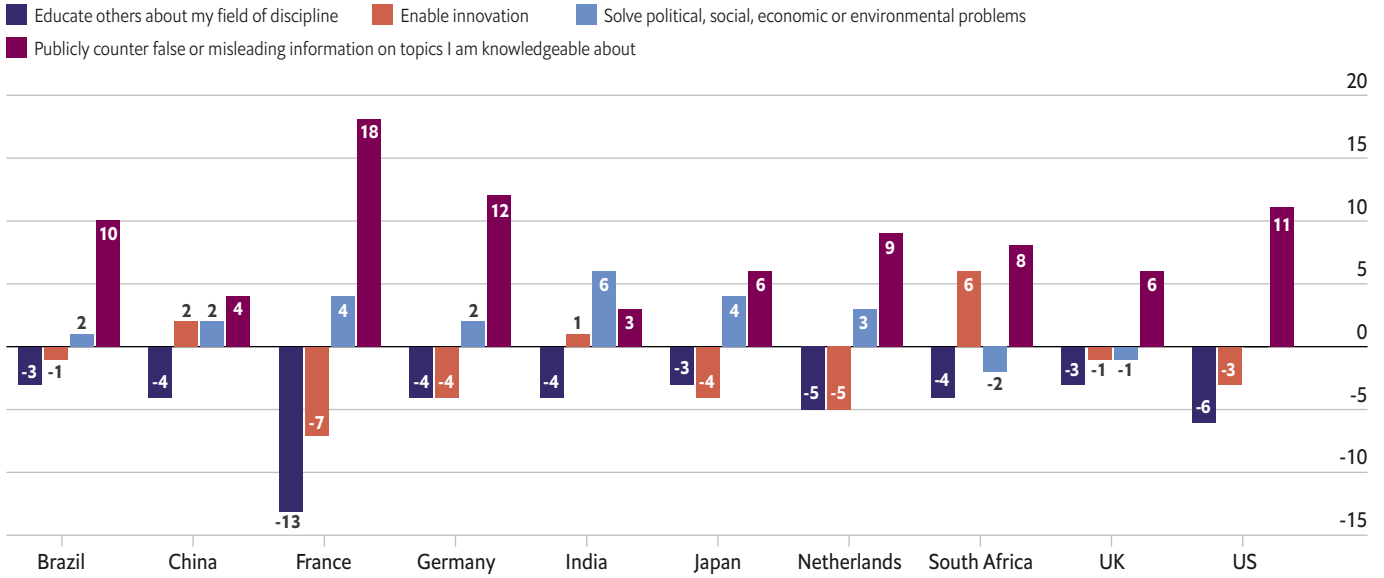
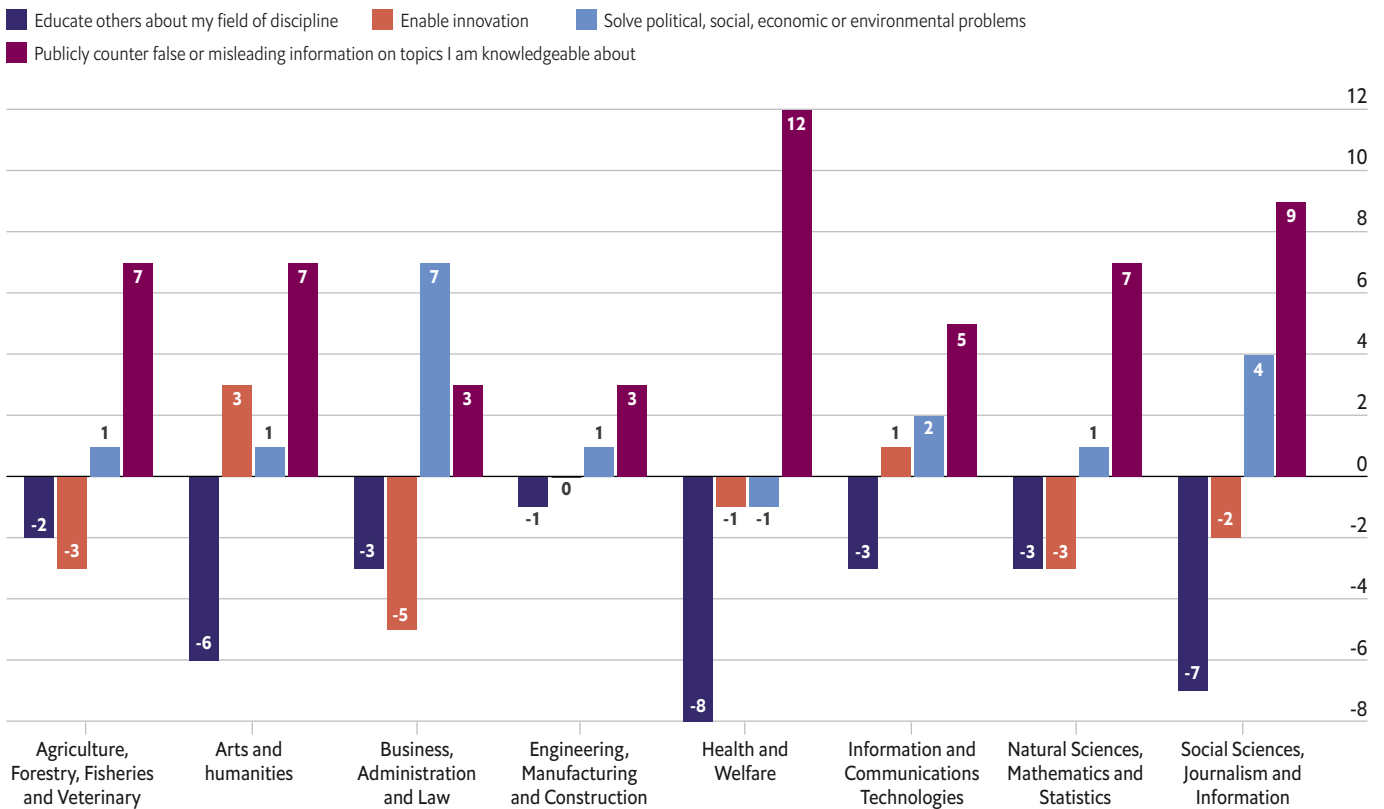


Figure 6: Shift in researchers' self-perceived role in society, before and after the pandemic

Percentage point change today compared with before the pandemic.



Note: Sample size (N), unweighted: Agriculture, Forestry, Fisheries and Veterinary (N=221), Arts and humanities (N=157), Business, Administration and Law (N=133), Engineering, Manufacturing and Construction (N=725), Health and welfare (N=731), Information and Communication Technologies (N=318), Natural Sciences, Mathematics and Statistics (N=1028), Social Sciences, Journalism and Information (N=642)
 Respondents to our survey were given the option to select all the disciplines that applied to their subject area of expertise

Conducting research in public view: a more public-facing researcher

In that sense, **a lesson that quickly emerged from the pandemic was that increased public attention on research does not necessarily translate into a greater public understanding of how research is conducted.** Increased public attention and the rise of misinformation may also be reshaping the role of the researcher, affecting their behaviour and presenting them with a new set of trade-offs. But our research suggests that this picture looks different for researchers in different disciplines as increased public attention on research in general does not seem to translate across all fields. When asked about their specific fields of expertise, 44% of the researchers we surveyed who were working in Health and Welfare feel that the pandemic saw increased attention and scrutiny in their field of research, compared with just 21% of researchers working in Arts and Humanities.

Peer who? Pre-what? Misunderstandings around the research process

As research takes the spotlight, the issue of misinformation becomes increasingly intertwined with the gap between public attention and public understanding of the research process. Indeed, **our survey found that while most respondents (63%) believe that the**

pandemic has increased public attention and scrutiny on research in general, just 38% agree that the pandemic will leave a legacy of greater public understanding of research and the peer-review process. In that sense, discussions during the UK roundtable highlighted that in some instances, as the research community rushed to share information early and transparently, publications themselves risked becoming a source of misinformation. This is because, they said, research was being published as a preprint without sufficient public understanding of the caveats that came with it. Findings from a preprint publication were therefore being taken as no different to those from a reputable peer-reviewed publication.

But for Dr Miranda-Nieto, this is also about the difficulties associated with communicating the uncertainty of research. “Researchers in Latin America, for instance, felt that people were more receptive to expert voices, but there were competing narratives and researchers struggled to communicate this. The way in which researchers phrase findings often consists of words like “would”, “perhaps”, “maybe”, “potentially”—all of which were very important because they didn’t have sharp answers—but the media instead repackaged findings by removing these words of caution and framing things as certainties”, he explains.

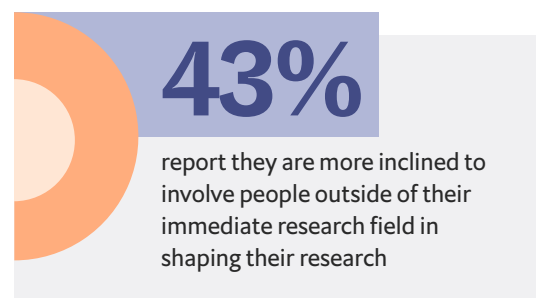
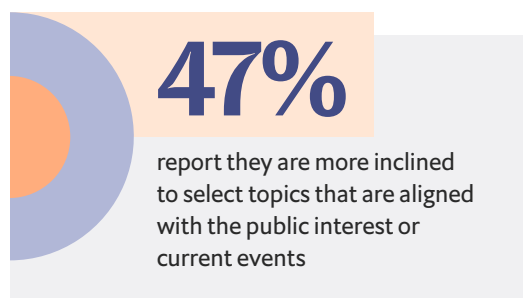
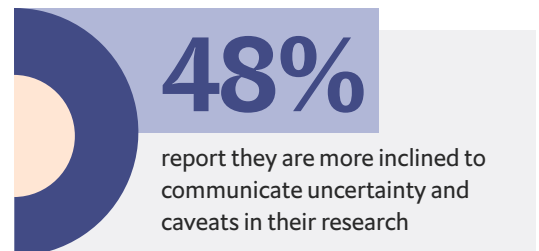


Misinformation is also a product of a mismatch between what researchers understood to be true and what the public understood: while conflicting results and uncertainty were commonplace for researchers, the public, media and policymakers saw this as a cause for concern and a source of distrust.

In this context, Dr Francis Kombe, CEO, EthiXPERT, NPC-SA, Wellcome Trust funded DPhil student at the School of Applied Social Sciences (Psychology); University of KwaZulu-Natal (UKZN), is concerned that as the public began seeing the processes behind the results, and at times the publishing of wrong results, it opened space for misinformation and distrust. A participant in the Japanese roundtable echoed this, saying that, "if just [research] results are shared without [an accessible explanation] of how you got there, it can cause mistrust."

Misinformation is also a product of a mismatch between what researchers understood to be true and what the public understood: while conflicting results

and uncertainty were commonplace for researchers, the public, media and policymakers saw this as a cause for concern and a source of distrust. Our survey suggests that researchers turn to peer review and study design to separate quality information from misinformation, but they cannot take for granted that the public, policymakers or the media place equal emphasis on these factors. Both researchers and the public want to have confidence in the research being put out in the world. Confidence in research, therefore, depends on a stronger foundation between the research community and the public, and stronger attempts to narrow the gap between public attention and public understanding.



“The public needs to understand the uncertainty that underlies science and that it is a process. Due to increased public attention, the public expects quick and straightforward results, which puts a lot of pressure on scientists.”

Dr Koso, Director of NBRP Public Relations Office, National Institute of Genetics, Japan



Adjusting behaviours

As research takes the spotlight, how are researchers adjusting to it? Our survey finds that researchers are beginning to report minor changes in the way in which they are going about their research. First, and perhaps in response to the higher levels of perceived attention and scrutiny in general, **researchers in our survey report that they are more likely to adopt better research practices following their experience of the pandemic.** Overall, they are reporting they are more inclined to have their work peer reviewed, attempting to be more transparent with their data, and looking for ways to collaborate across disciplines.

Second, **our survey suggests that researchers across the board appear to be exerting more caution in their approach.** Across regions, the majority of researchers say they are now more inclined to communicate the caveats and uncertainties of their research. This could be a response to concerns around misinformation, but also an attempt to start making the research process more accessible and balancing the public’s demands for rapid certainty with the complex realities of research. “The public needs to understand the uncertainty that underlies science and that it is a process. Due to increased public attention, the public expects quick and straightforward results, which puts a lot of pressure on scientists. Science now advances quite rapidly compared with a few decades ago, which gives the impression that it is certain. Covid, I think, has furthered this impression. So

now, there is a need to place a careful importance on uncertainty, but it’s a difficult task, because it’s much easier to look at—and explain—findings and facts rather than the process in itself”, argues Dr Koso, Director of NBRP Public Relations Office, National Institute of Genetics, Japan.

Finally, **researchers seem eager to make their research more relevant.** Our survey results indicate that as a result of the pandemic, 47% of respondents globally are now more inclined to select topics that align with public interests or current events. This could be in response to a desire to improve social outcomes and influence policymakers. But it could stem from pressures from funders. Since the pandemic, 53% of respondents feel that funders now have more influence over the selection of research topics. Indeed, participants in the German roundtable warned that “listening can be dangerous”, as pressure groups can push research funds so far in one direction that other issues are neglected. In this context, participants in the Chinese roundtable cautioned against “choosing topics based purely on the preferences of government, funders and research institutions”, and called on researchers to select topics that solve global problems and engage in “original, interdisciplinary research”.

A balancing act

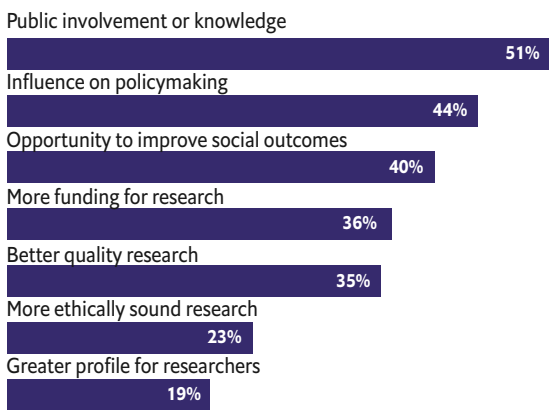
The increased public attention on research comes with trade-offs for the research community. When asked about the main benefits associated with increased public

attention, respondents report benefits in more public involvement and knowledge about research topics, more influence on policymaking, and greater opportunities to improve social outcomes. Public attention may also improve the calibre of research, with a majority of researchers surveyed agreeing that a lasting impact of the pandemic will be increased scrutiny on how

research is conducted, and just over a third hopeful that better quality research will be a key benefit (see Figure 7a). But these upsides balance against important concerns that the researchers in our survey have about the politicisation of research, oversimplification and a lack of public understanding regarding how research is conducted (see Figure 7b).

Figure 7a: The benefits of increased public attention

Percentage of respondents selecting as one of the top 3 benefits.



Note: Sample size (N), Total respondents: (N = 3144)

Figure 7b: The challenges of increased public attention

Percentage of respondents selecting as one of the top 3 challenges.



Note: Sample size (N), Total respondents: (N = 3144)

COUNTRY SPOTLIGHT

The US' pronounced misinformation challenge

Our research suggests that US researchers are facing a pronounced misinformation challenge. When asked about the impacts of the pandemic, 78% of US researchers surveyed feel that it increased the importance of separating quality information from misinformation, compared with the global average of 69%. Yet bullying and harassment online is also a particularly big issue in the US. Of the US researchers we surveyed, 44% have experienced or know someone who has experienced abusive or acrimonious interactions online, compared with the global average of 32%. The researchers we engaged with in the roundtable pointed to how this was an impediment to the willingness of researchers to engage in open communication.

As a result, it is not surprising that amongst the US researchers we surveyed, only around a third (35%) actually enjoy engaging in discussions about their research online or on social media, compared with the global average of 47%. Furthermore, our survey suggests that they are even more averse since the pandemic: 36% of US researchers are now less inclined than they were before the pandemic to share their opinions on social, economic or environmental issues via social media, compared with the global average of 23%.

Looking ahead, politicisation is a strong concern, with a majority (79%) of US respondents selecting this as one of the top challenges associated with increased public attention on research, compared with the global average of 56%. In this context, US researchers are calling for interventions that target these elevated concerns and challenges. Our survey indicates that a quarter (24%) of US researchers would value more support in the face of bullying, harassment and/or trolling, compared with the global average of 17%. More specifically, based on roundtable discussions, researchers are calling on early-stage training on open communication with peers and the public, protection from institutional officials and scientific and/or research societies in the case of online harassment, and rewards (rather than punishments) for researchers who "stick it out".

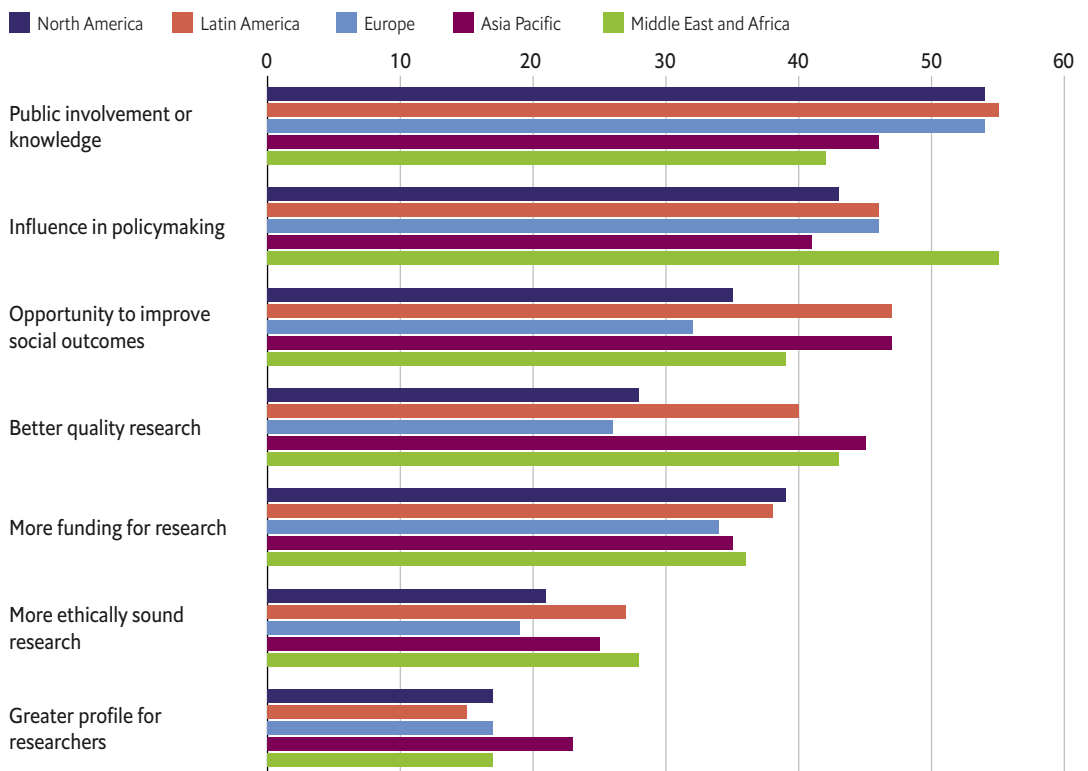
COUNTRY SPOTLIGHT

China’s high-pressure environment

Covid-19 may have set a new precedent for research coming from China. Reflecting caseloads and pandemic trends, the number of submissions from China rose dramatically in the initial stages of the pandemic, accounting for a significant majority (around 47%) of all Covid-19-related articles in the first three months of the pandemic. This figure dropped to about 16% between July and October 2020, ranking China third after the US and Europe.⁷⁴ Looking ahead, our survey suggests that researchers in China are concerned about the extra commitments that could be associated with conducting research in the post-pandemic era, with just under half (45%) citing this as a key challenge. During the roundtable discussion with Chinese researchers, there was consensus that China’s research landscape is increasingly being characterised as one of “over-competition” with growing public demand for “fast and accurate” information that sets higher expectations and new challenges for researchers. According to participants, technology and modes of science communication are also adding to these demands for fast information. And these pressures are inhibiting proper engagement with the public: “High work pressure is the reason why researchers, especially young researchers, do not have the time and motivation to perform science popularisation. Therefore, such work should be incorporated into evaluation indicators to increase their engagement.”

Figure 8: Benefits of public attention by region

Percentage of respondents selecting as one of the top 3 benefits.



For researchers surveyed in the Middle East and Africa, the pandemic could be an opportunity to reach their target audiences more effectively. 55% of these researchers selected influencing policymaking as a top benefit, compared with the global average of 44%.

Note: Sample size (N), weighted: North America (N = 849) Latin America (N = 126) Europe (N = 817) Asia Pacific (N = 1163) Middle East and Africa (N = 189) Significant differences (at 95% confidence levels) when comparing the sub-group against the overall mean (% selecting agree). An Asterisk (*) indicates the subgroup result is higher than the overall mean while a Dagger (†) indicates it's lower.

⁷⁴Cai, X et al. (2020). International Collaboration During the COVID-19 Crisis: Autumn 2020 Developments Available at SSRN: <https://ssrn.com/abstract=3729672> or <http://dx.doi.org/10.2139/ssrn.3729672>

REGIONAL SPOTLIGHT

Empowering researchers in the Middle East and Africa to influence policymaking

The results of our research suggest that in the Middle East and Africa, researchers are particularly excited about having more influence on policymaking post-pandemic. Our survey's sample for the region is dominated by responses from South Africa (N=73) and, to a lesser extent, Iran (N=31).⁷⁵ Both these countries are increasingly major research players in their respective sub-regions. Iran, for instance, saw the ratio of co-authored publications increase from 21% in 2015 to 28% in 2019. Similarly, South Africa increased its ratio of internationally co-authored publications from 54% to 57% since 2015.⁷⁶

Beyond increasing the importance of health-related issues, Covid-19 also elevated the policy relevance of digital technology adoption.⁷⁷ Looking ahead, the Southern African region is seeking to prioritise technology innovations in the realms of fintech, health, education and agriculture.⁷⁸ Across the board, however, there is a push for greater research impact at the policy level. Launched in 2020, the African Union's Science, Technology and Innovation Strategy for Africa for 2024, for instance, aims to "accelerate Africa's transition to an innovation-led [and] knowledge-based economy".⁷⁹ Similarly, in the Arab states, the Gulf Cooperation Council has been prioritising the move to a "knowledge-based economy", and in turn trying to enhance the region's research capacities.⁸⁰

In this context, our results suggest that they are hopeful the pandemic will allow them to play a bigger role in policymaking: 55% of respondents in the region selected influencing policymaking as a top benefit associated with increased public attention, compared with 44% globally. A majority (64%) are calling for more opportunities to engage with policymakers, compared with 46% calling for this in Europe. Our survey results also indicate that Middle East and Africa respondents are aligning their research to suit these objectives and possibilities. Over two thirds (67%) of researchers surveyed in the region reported more inclination to select research that aligned with the public interest or current events, compared with 37% in Europe, 40% in North America and 47% globally.

But this might get more complicated when discussed from an international perspective. UNESCO's science report found that in 2008, Sub-Saharan Africa contributed to just 0.8% of global scientific publications, and the Arab States contributed to 1.7%.⁸¹ This figure has since risen to 1.8% for Sub-Saharan Africa and 3.6% for Arab States in 2019, but still represents a small share of global knowledge production, which is currently dominated by Europe (35%), East and Southeast Asia (37%) and North America (23%).⁸² This largely stems, particularly in the case of Sub-Saharan Africa, from poorer research infrastructure, lack of funding or lack of resources. But is also an outcome of "helicopter research", which sees researchers from the Global North conduct research within the Global South, and researchers from the Global South excluded in the early stages of research.⁸³ This leads to research and policy outcomes that do not include local perspectives, or, as Dr Kombe highlights, the top-down implementation of policies. "Influencing [international] policy outcomes is much easier in the Global North. Most times it's research from the Global North that gets pushed onto the Global South; the opposite is not happening. It is much harder for something discovered in the Global South to have policy implications to, let's say, be accredited by the FDA or supported by the WHO", he says.

⁷⁵ The majority of responses from the Middle East and North Africa region came from South Africa (N=73) and Iran (N=31), but also included responses from Nigeria (N=16), Ethiopia (N=11), Iraq (N=9), Ghana (N=7), Turkey (N=6), Egypt (N=4), Israel (N=3), Algeria (N=2), Cameroon (N=2), Jordan (N=2), Oman (N=2), Tanzania (N=2), Tunisia (N=2), Zimbabwe (N=2), Afghanistan (N=2), amongst others. As a result, the discussion on findings from this region are not necessarily representative of the entire region, and are skewed to represent responses from South Africa and to a lesser extent, Iran.

⁷⁶ UNESCO. (2021). UNESCO Science Report: the race against time for smarter development. United Nations.

⁷⁷ OECD. (2021). How will Covid-19 shape science and technology innovation? OECD. https://read.oecd-ilibrary.org/view/?ref=1098_1098772-3qmm9rpta1&title=How-will-COVID-19-reshape-science-technology-and-innovation

⁷⁸ UNESCO. (2021). UNESCO Science Report: the race against time for smarter development. United Nations.

⁷⁹ African Union. (2020). Science, Technology and Innovation Strategy for Africa 2024.

⁸⁰ PricewaterhouseCoopers. (2019). Advancing academic research in the GCC.

⁸¹ UNESCO. (2010). UNESCO Science Report 2010. United Nations.

⁸² UNESCO. (2021). UNESCO Science Report: the race against time for smarter development. United Nations.

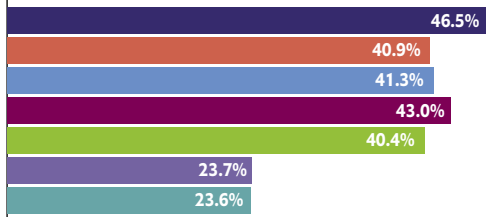
⁸³ Amarante, V et al. (2022). Underrepresentation of developing country researchers in development research, *Applied Economics Letters*, 29(17), 1659-1664; Haelewaters, D, Hofmann, TA & Romero-Olivares, AL. (2021). Ten simple rules for Global North researchers to stop perpetuating helicopter research in the Global South. *PLOS Computational Biology* 17(8): e1009277.

Figure 9: Benefits of public attention by expertise

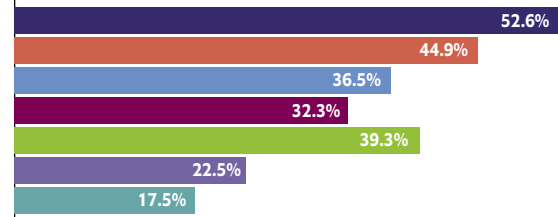
Percentage of respondents selecting as one of the top 3 benefits.

- Public involvement or knowledge
- Influence on policymaking
- Opportunity to improve social outcomes
- Better quality research
- More funding for research
- More ethically sound research
- Greater profile for researchers

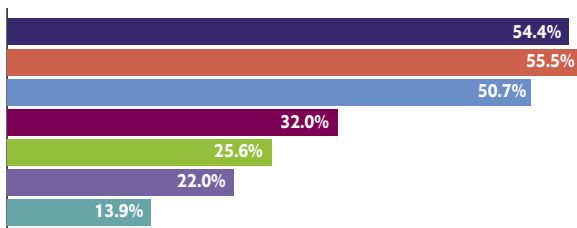
Engineering, Manufacturing and Construction



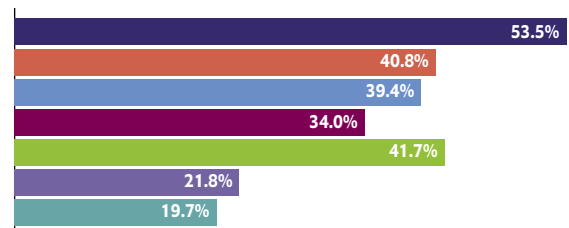
Health and Welfare



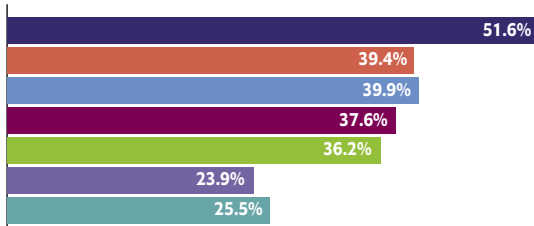
Social Sciences, Journalism and Information



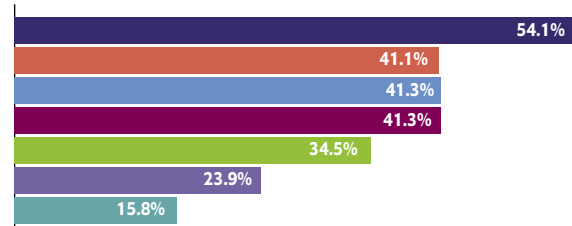
Natural Sciences, Mathematics and Statistics



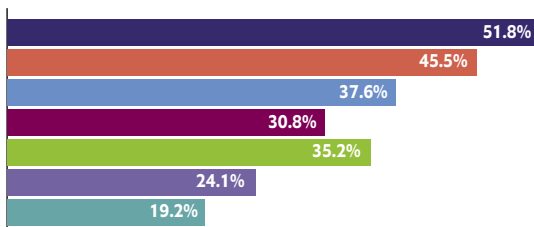
Information and Communication Technologies



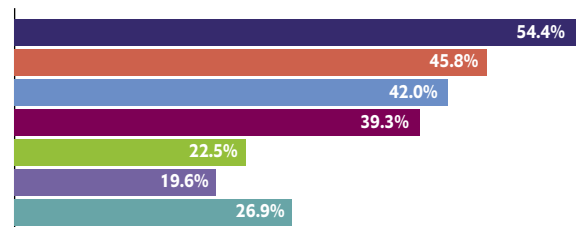
Agriculture, Forestry, Fisheries and Veterinary



Arts and humanities



Business, Administration and Law



Researchers in social sciences, journalism and information rate two post-pandemic benefits significantly higher than their counterparts in other fields: the influence on policymaking (56% vs global average of 44%) and the opportunity to improve social outcomes (51% vs 40%).

Note: Sample size (N), unweighted: Agriculture, Forestry, Fisheries and Veterinary (N=221), Arts and humanities (N=157), Business, Administration and Law (N=133), Engineering, Manufacturing and Construction (N=725), Health and welfare (N=731), Information and Communication Technologies (N=318), Natural Sciences, Mathematics and Statistics (N=1028), Social Sciences, Journalism and Information (N=642)

Respondents to our survey were given the option to select all the disciplines that applied to their subject area of expertise

EXPERTISE SPOTLIGHT

A more public-facing role for health researchers

According to the results of our survey, researchers working in Health and Welfare felt the spotlight of public attention most acutely: 67% felt that the pandemic increased public attention on research in general, and 44% felt that the pandemic saw increased attention and scrutiny in their specific field of expertise, compared with just 21% of researchers working in Arts and Humanities.

Unsurprisingly, the Health and Welfare researchers we surveyed are also more concerned about misinformation and the new responsibilities associated with this. The importance of publicly countering misinformation jumped by 14 percentage points since the pandemic, compared with an average of seven percentage points. Additionally, 73% of health researchers agreed that the pandemic increased the importance of separating quality information from misinformation, compared with the global average of 69%.

With this uptick in public attention, and perhaps in an attempt to keep the momentum going, they are particularly keen on communications training. A majority of researchers in Health and Welfare (60%) are calling for more communications training so that they can better their ability to engage with an increasingly interested public and counter misinformation. This figure is higher than the global average of 54%.

EXPERTISE SPOTLIGHT

What do other disciplines hope to get out of increased public attention on research post-pandemic?

While health-related subjects are enjoying a natural spotlight, our findings suggest that researchers in other disciplines are also seeing a silver lining post-pandemic, notably the possibility to better tackle pressing issues such as climate change, education or poverty.

Social Sciences, Journalism and Information: pushing for policymaker attention

Our research suggests that respondents working in Social Sciences, Journalism and Information seem intent on capitalising on the benefits of increased public attention for the greater good, with more than half (58%) saying their role post-pandemic is to solve political, social, economic or environmental problems. According to the results of our survey, researchers in Social Sciences, Journalism and Information also rate two post-pandemic benefits significantly higher than their counterparts in other fields: 56% of these researchers selected greater influence on policymaking as a key benefit, compared with 44% of researchers overall, and 51% selected the opportunity to improve social outcomes, compared with 40% of researchers overall. Given their hopes for more policy involvement, these researchers are the most keen on having more opportunities to engage with policymakers: two-thirds are calling for more of this.

Engineering, Manufacturing and Construction: innovating and working with industry

The upsides of public attention are also perceived in Engineering, Manufacturing and Construction, where just under a third (32%) of respondents feel that public attention increased in their field of expertise. Here, our results indicate that nearly two thirds (65% vs 46% overall) cite enabling innovation as a key aspect of their role. Researchers in these disciplines appear keen to leverage increased attention on research to influence corporate earnings and growth. As such they are significantly more likely to perceive high levels of interest from corporations in their field of research (with 34% reporting high interest, compared with 22% overall) and to seek more opportunities to engage with industry (with 70% saying so, compared with 49% overall).

Arts and Humanities: pursuing social impact through education

Respondents in Arts and Humanities appear less upbeat about the pandemic, reporting the lowest levels of increased public attention in their field (21% vs 33% overall). They nevertheless spot a post-pandemic opportunity to have a concrete social impact: not only by further educating the public about their field, with seven-in-ten considering the educator aspect of their role as central, but also by being active in solving political, social, economic or environmental problems (as cited by 46%). Interestingly, despite displaying the highest level of confidence in their ability to communicate on social media (with 25% of respondents rating it very high, compared with 18% on average), researchers in this field also reported the highest rates of bullying and/or harassment online: 46% of these researchers have experienced or know a close colleague who has experienced abusive or acrimonious communications online, compared with the global average of 32%. Most of these were in the form of abusive public comments.

Confidence boost: supporting researchers to take on a more public role

Researchers—some more than others—want to contribute to policy and social outcomes in meaningful ways, and hope that their research can continue to play a role in solving global problems. But increased public attention on research is not a guarantee, and according to Dr Iqbal, it has already waned. In that sense, it is up to the research community to leverage the momentum that was created during the pandemic. Effective communication of research findings, as well as the research process, will be key in this regard. Not only do our respondents perceive a demand for communication skills, there also appears to be a gap between what the researchers we surveyed feel equipped to do and what they feel will be increasingly required of them.

Demands for communication skills

Our results point to a perceived demand for communication and interpersonal skills: when asked what they believe policymakers value, just 29% of researchers in our survey say the quality of study design and 33% say the reputation of the journal it's published in (see Figure 10). Instead, the most important determinant, according to our respondents, is personal connections: half (49%) feel that personal connections are a key determinant of whether research is picked up and used by policymakers. According to Dr Kombe, “this mismatch between credible quality research and

how policymakers deem research to be credible is a key challenge to confidence in research at the policy level. As often policy is not oriented alongside the best research but along the research that has the most lobbying involved. As a result, choosing research for policy ends up being political.”

Though with the sheer pace at which the pandemic developed and as demands for quick answers and certainty increased, so too did the pressure for policymakers to sift through large volumes of information. It is unsurprising, then, that they relied first on connections and the clarity of communication over the substance of the research. In that sense, the pandemic elevated the importance of communication for researchers to influence policy outcomes. In this context, however, and linking to discussions on the disproportionate impacts of the pandemic on the Global South, a participant of the Global Expert Panel raised an important question: “did the pandemic exacerbate attention on the best-connected research [which typically comes from the Global North] rather than necessarily the best?”

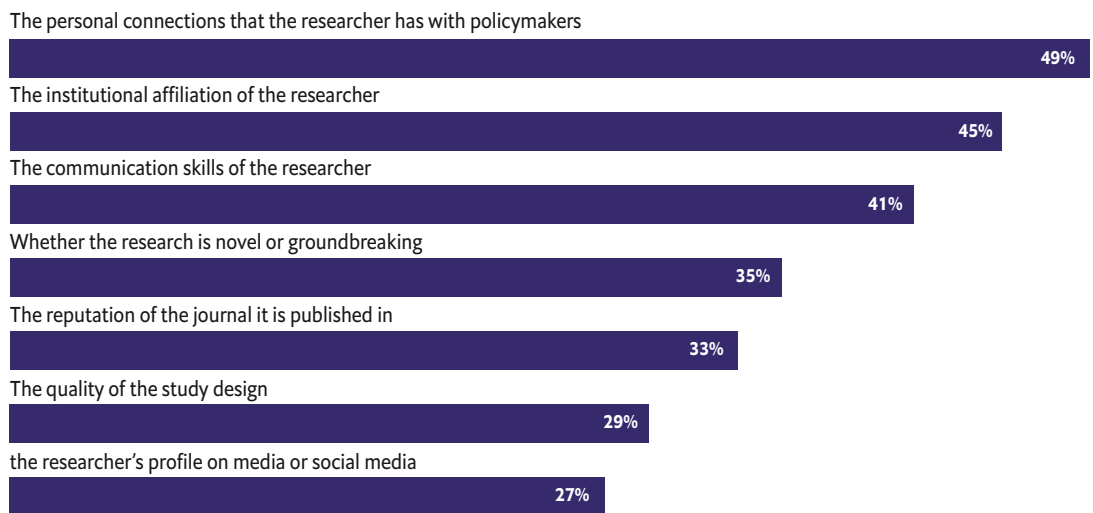
These results suggest that if sound research is to form the basis of policymaking, channels of communication between policymakers and the research community need to be strengthened—not only in times of crisis. The researchers we spoke with suggested some interventions relevant to

These results suggest that if sound research is to form the basis of policymaking, channels of communication between policymakers and the research community need to be strengthened—not only in times of crisis.



Figure 10: Factors affecting policy maker uptake research (according to researchers)

Percentage of respondents selecting as one of the top 3 determinants of whether research in a relevant subject is used by policymakers.



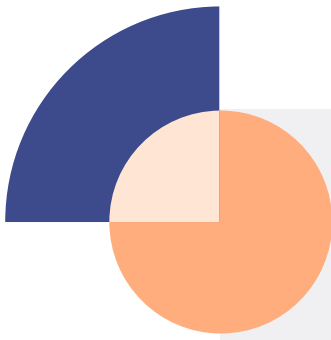
Note: Sample size (N), Total respondents: (N = 3144)

this (see Key takeaways and areas for action below). This would ensure that policymakers can better understand the nuances of the research process. Ultimately, however, it would help boost the confidence of researchers to know they can access the right people, and the confidence of policymakers to know they can access the right research.

Can researchers fill this demand for communication?

If communication and interpersonal skills are to become more central pillars of the researcher's role, how confident do

researchers feel in their own abilities to fill this demand? According to our survey, researchers feel confident in their methodological capabilities, but lack the same level of confidence in their communication skills. While over half (55%) of respondents report having a lot of confidence in their ability to design replicable research methods, and almost half (47%) have a lot of confidence explaining research *methods* to the public, less than a third report the same level of confidence in communicating *findings* to policymakers, journalists and via social media (see Figure 11).



“This mismatch between credible quality research and how policymakers deem research to be credible is a key challenge to confidence in research at the policy level.”

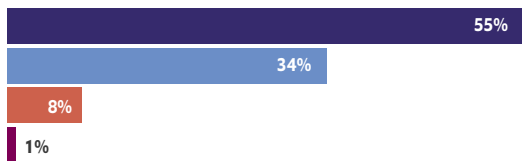
Dr Kombe, CEO, EthiXPert, NPC-SA, Wellcome Trust funded DPhil student at the School of Applied Social Sciences (Psychology); University of KwaZulu-Natal

Figure 11: Confidence in research methods and communication

■ A lot of confidence ■ Some confidence ■ A little confidence ■ No confidence

Confidence in research methods

Designing replicable research methods

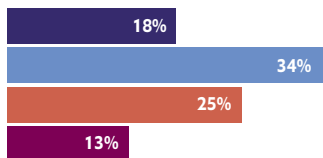


Explaining research methods publicly

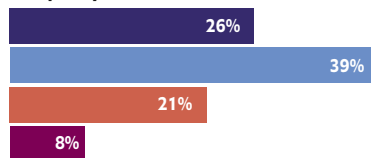


Confidence in communicating research findings

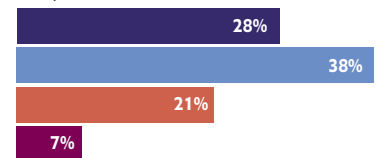
...on social media



...to policymakers



...to journalists



Note: Sample size (N), Total respondents: (N = 3144)

More specifically, the results of our survey suggest that researchers feel particularly ill equipped to communicate their research findings via social media: just 18% have a lot of confidence in this. Though some researchers are more confident than others.

Unsurprisingly, distinguished researchers report higher levels of confidence communicating than their more junior counterparts. 38% of distinguished researchers in our survey report having a lot of confidence communicating research findings with policymakers, compared with 21% of early-career researchers; and 43% of distinguished researchers have a lot of

confidence communicating with journalists, compared with 22% of early-career researchers. On social media, more senior researchers are also comparatively more confident, albeit to a lesser extent: 24% of distinguished researchers surveyed have a lot of confidence communicating via social media, compared with 18% of early-career researchers.

Do researchers want to fill this demand?

Ability is one thing, willingness is another. The results from our survey suggest that many researchers are open to engaging in more open

channels of communication. When asked about their attitudes towards engaging in discussions about their research online or on social media, almost half of researchers globally enjoy it, and over half see it as both a responsibility as well as an opportunity to develop their reputation in their field.

Unsurprisingly, early-career researchers tend to place more value on social media and online engagement than their more experienced counterparts. Of the researchers surveyed, 49% of early-career researchers enjoy it, compared with 44% of distinguished researchers. Our results also suggest that social media is being seen as an increasingly important aspect of their role: 54% of early-

career researchers feel a responsibility towards it, compared with 47% of distinguished researchers; and 58% feel that it will boost their reputation, compared with 45%. Dr Mwaura thinks that this is indicative of a more public-facing new generation of researchers. "Having grown up with the internet, early-career researchers are more likely to publish in non-traditional formats, such as blogs, news, documentaries, and on social media. I think they are taking research to the next level, and are keen to break through the traditional barriers of research and make research outputs accessible to more people", he says.

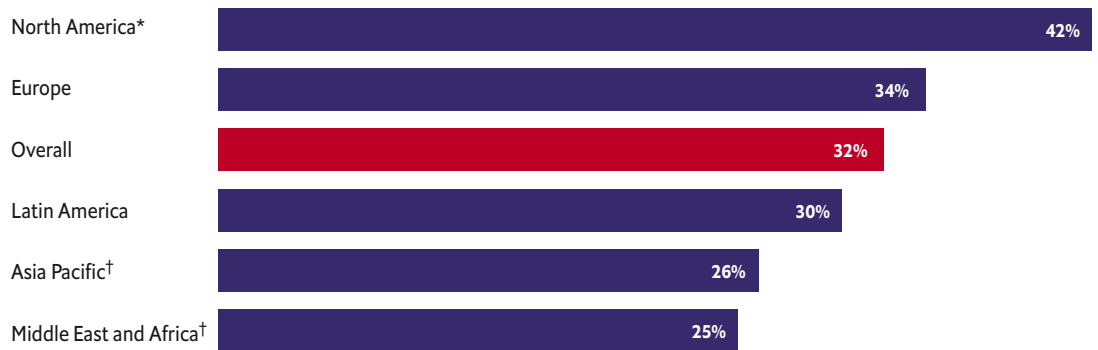
Early-career researcher respondents also appear more attentive to the societal elements of research. When asked about factors that could help boost their confidence to cite a piece of research, 61% of early-career researcher respondents feel that strong indicators of social or economic impact would increase their confidence, compared with 49% of distinguished researchers and 57% of researchers overall. This suggests that not only are early-career researchers adopting more public-facing approaches to research by embracing social media and online forms of communication, they are also more likely to see societal factors as factors that affect their assessment of the reliability of others' research. This appetite for online and more public-facing forms of communication sits in contrast to their comparatively lower levels of confidence in communicating, pointing to a gap that needs to be filled.

Additionally, social media is gaining traction in some countries more than others. In China, 25% of researchers who responded to our survey reported a lot of confidence on social media, and over half (55%) said that they enjoy it. This sits in contrast to researchers in Germany, where less than 10% have a lot of confidence



Figure 12: The prevalence of online abuse

Percentage of researchers who have experienced or know a close colleague who has experienced online abuse



Note: Sample size (N), weighted: North America (N = 849) Latin America (N = 126) Europe (N = 817) Asia Pacific (N = 1163) Middle East and Africa (N = 189)
 Significant differences (at 95% confidence levels) when comparing the sub-group against the overall mean. An Asterisk indicates the subgroup result is higher than the overall mean while a Dagger indicates it's lower.

communicating via social media, and just under a third (30%) enjoy using it. Similarly, in the UK and US, less than 15% have a lot of confidence in these skills, and around a third (34% and 35%, respectively) enjoy it. Japan is a bit of an outlier here: though just under 10% have a lot of confidence communicating via social media, almost half (48%) claim to enjoy using it. The outcomes of our roundtable discussion with Japanese researchers suggest that while the skills are lacking, demand could be there if properly rewarded.

In this context, the type of online environment that researchers need to navigate will play a key role. **According to our survey, nearly a third (32%) of respondents globally report having experienced or knowing a close colleague who has experienced abusive or acrimonious communications online, most commonly in the form of abusive public comments or acrimonious debate on public platforms.** A quarter of researchers surveyed (24%) also highlight the increased risk of bullying and/or harassment as one of the main challenges of increased public attention to research (see Figure 7b above). A hostile online environment will only make it more difficult for researchers to embrace a more public-

facing role going forward. In the face of these interactions, support and guidance from their institutions' press and legal departments, as well as senior leadership, will be key.

Communication: better, not more

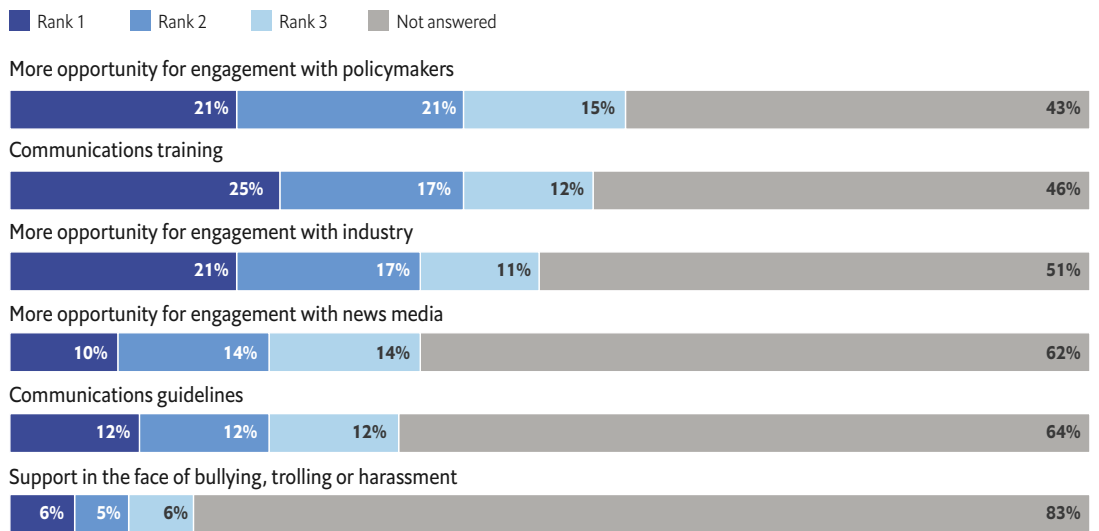
To bridge this demand gap, the support that the researchers we surveyed would find most useful for communication are more opportunities to engage with policymakers (57%), communications training (54%), and opportunities for more engagement with industry (49%) (see Figure 13). Combined, these could help researchers feel more confident in their ability to communicate not just the outcomes of their research, but also the caveats and uncertainties that they hope to better convey. It would also ensure that relevant stakeholders are more consistently exposed to the realities of the research process. "The communication about the research on vaccine development has allowed people to not only understand the process better but to have hope and gain trust in the overall research process. So if communication around science is scaled up and improved in the future, it could potentially lead to an increase in overall trust in science", says Dr Kombe.

Institutional incentives also need to improve. Respondents to our survey feel that while publication in journals matters most, it is somewhat overvalued by institutions when it comes to rewarding their work. Instead,

researchers are calling on institutions to better recognise their commitment to teaching, public engagement and influencing policymakers (see Figure 14).

Figure 13: Interventions that respondents would find most useful to communicate research more effectively

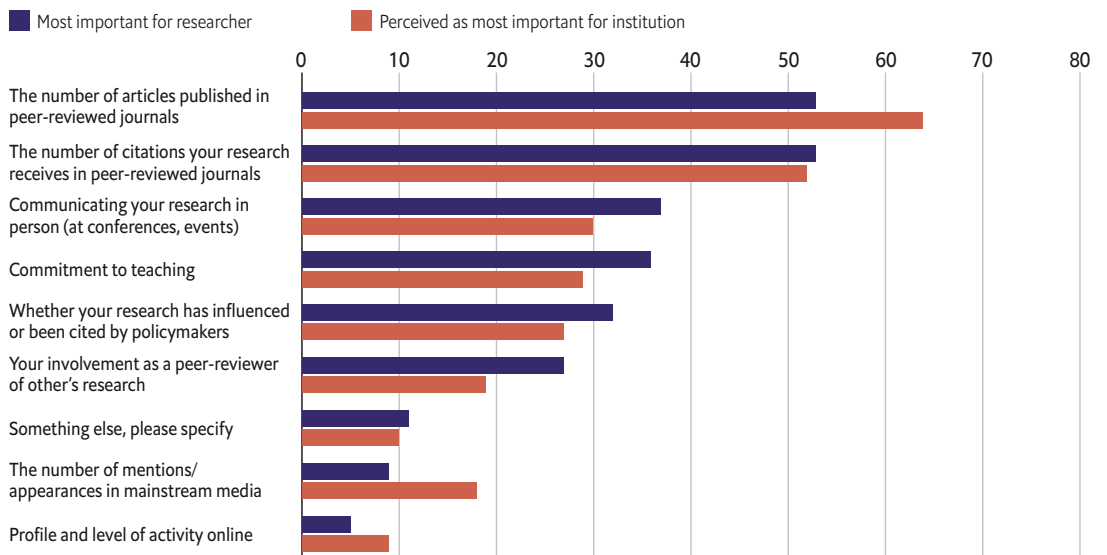
Top 3 interventions, ranked in order of preference, where one equals most useful.



Note: Sample size (N), Total respondents: (N = 3144)

Figure 14: What respondents feel should be rewarded for career progression, versus what they feel institutions reward

Percentage selecting as one of the top 3 important factors.



Note: Sample size (N), Total respondents: (N = 3144)

“We should have a more participatory, two-way approach to communication that involves the researcher and the audience. It shouldn’t be one way, where the expert teaches, but a dialogue, where the audience is engaging in a conversation.”

Dr Koso, Director of NBRP Public Relations Office, National Institute of Genetics, Japan



That being said, a lot is already being demanded of academics, and with varying levels of confidence and openness to direct communication, and challenging online environments, not all researchers want to or should be communicators.

Additionally, though social media and online channels have opened up the space for more direct interactions between the public and researchers, they have also added to the sheer volume of information out there and made it more difficult for traditional media and experts to act as “gatekeepers” of scientific information.⁸⁴ The demand for communication must therefore be met strategically. For the researchers we spoke to, this entails using a specialisation model: where all researchers are given the opportunity to engage with the public, but with the support of dedicated science communicators (see Key takeaways and areas for action below). It also involves emphasising a participatory approach to communication.

“What does effective communication look like? We should have a more participatory, two-way approach to communication that involves the researcher and the audience. It shouldn’t be one way, where the expert teaches, but a dialogue, where the audience is engaging in a conversation.”, explains Dr Koso.

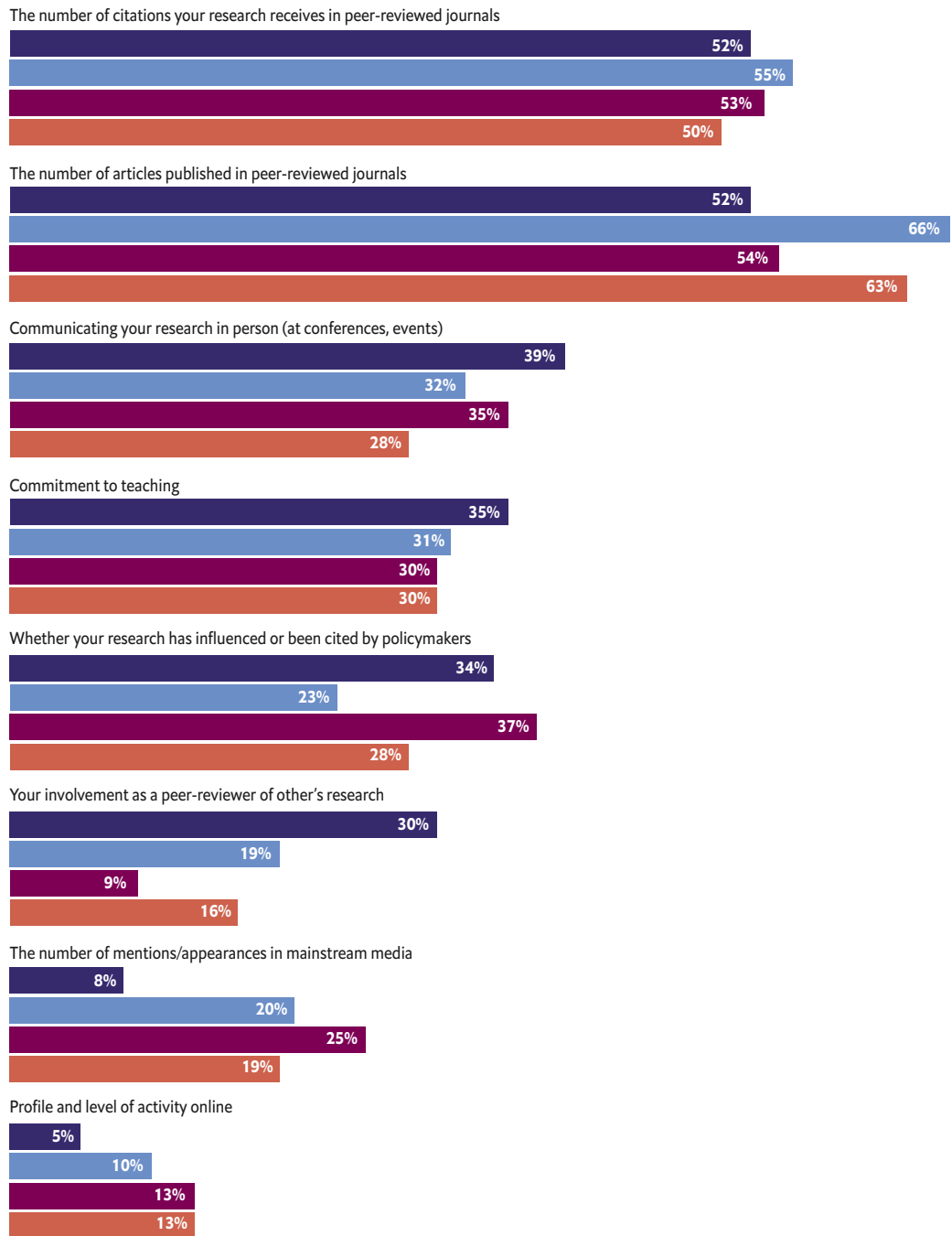
Some researchers will need more support than others. Early-career researchers in our survey, for instance, report the lowest levels of confidence in their ability to communicate with policymakers, journalists and via social media. This is despite the fact that, according to our survey, they appear particularly open and willing to embrace a more public-facing role and to communicate with the public in more diverse ways. Based on the results of our survey, they are calling for the following incentives to matter more than they currently do, and feel this more so than their more senior counterparts (see Figure 15).

⁸⁴Roedema, T et al. (2021). Who is going to believe me, if I say ‘I’m a researcher?’ — Scientists’ role repertoires in online public engagement. *JCOM* 20(3)

Figure 15: Institutional incentives by career stage

Differences between career stages in what respondents feel should be rewarded for career progression, versus what they feel institutions reward.

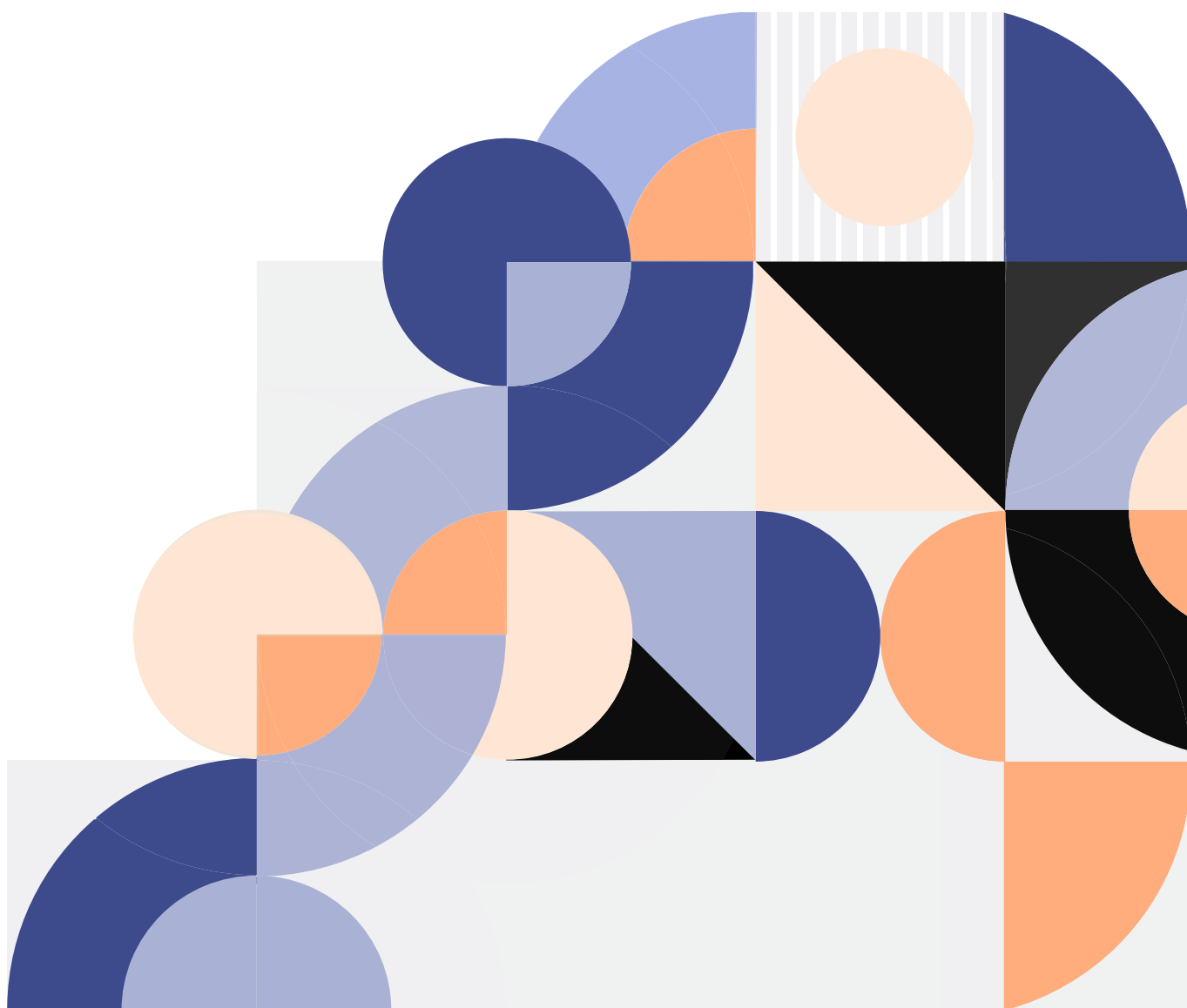
■ Early career researchers (should) ■ Early career researchers (is) ■ Others (should) ■ Others (is)



Early-career researchers who participated in our survey are calling for their involvement as a peer reviewer, communication efforts at events or conferences, and the degree to which their research has influenced or been cited by policymakers to matter more than they currently do.

Sample size (N), unweighted: Others (N=1953) * "Others" groups distinguished researcher and established researcher respondents

Key takeaways and areas for action



The research community responded to the pandemic, and the increase in public attention and scrutiny on research, by working around the clock to publish their results as soon as possible. This proved challenging, and many spoke about burnout and career setbacks. As research was published more frequently and more quickly, conflicting results inevitably emerged. For researchers, this was expected. Research is an iterative process.

However, the myriad studies and perspectives shared—some in preprints, some in peer-reviewed journals and others in predatory journals—were a source of confusion and at times distrust for some. Many in the research community stepped up to try and combat this. But this was a big responsibility to place on researchers across fields, geographies and career stages, leaving some researchers feeling ill-equipped, unsupported and at times apprehensive that they may face a backlash of online abuse.

The pandemic made it clear that researchers now face a new landscape they must adjust to,

which will ultimately call for a more public-facing role. This will require new skills, a new mindset and more time to devote to this element of their role. But while a brighter public spotlight makes good research more visible and accessible—for policymaking and public involvement in key social, economic and environmental issues—it also carries risks of misuse, misunderstanding and miscommunication.

In this context, how can the research community—universities, funders, publishers, media outlets, policymakers and researchers themselves—work together to adapt to a changing role with new demands and responsibilities? Following a series of in-depth interviews undertaken by Economist Impact, and six in-country roundtable discussions and a Global Expert Panel that we observed, we highlight a number of takeaways and suggestions for future efforts. In some instances, we reference existing initiatives that are helping to address some of these challenges, but these references are by no means exhaustive. For the most part, we wanted to reflect back the suggestions that we heard from researchers themselves.

| Key actors | Areas for action | Potential impact | |
|---|--|--|---------------------|
| 1. Researchers | Campaigns to counter misinformation | Addressing misinformation | |
| | Recognising peer-review contributions | | |
| 2. Universities and research institutions | Investing in public campaigns and bodies | Building public trust and understanding | |
| | Conducting research on the communication of research | | |
| 3. Funders | Promoting awareness of key research terminology | | |
| 4. Publishers and journals | Spotlighting the societal impact of research | | |
| 5. The media | Valuing interdisciplinary approaches, while being mindful of expertise | | |
| 6. Policymakers | More time, less admin | Preparing researchers for a public-facing role | |
| | Mentorships for early-career researchers | | |
| | Formalising communications training | | |
| | Establishing communication intermediaries | | |
| | Providing support in the face of online abuse | | |
| | 7. Social media platforms | Formalising science advisory institutions | |
| | 8. Information providers (e.g. librarians) | Making room for non-English speakers | Tackling inequality |
| | | Incentivising cross-regional collaborations | |

Addressing misinformation

Our research showed that some researchers are prepared to take on a more active role combating false or misleading information and communicating research findings to the public. But what role can universities, publishers, funders, policymakers and social media platforms play in providing tools to help separate quality research from misinformation?

Campaigns to counter misinformation

A lot of thinking has gone into understanding how mis- and disinformation spreads and what social media companies can do to prevent it, although it remains a “wicked problem”.⁸⁵ The WHO campaign to stop the spread was a collaboration with the UK government, highlighting the role of partnerships and policymakers.⁸⁶ Participants in the Global Expert Panel proposed greater collaboration in this regard with social media platforms. However, some research shows a lack of consistency and transparency about the guidelines and approaches of social media platforms.⁸⁷ Other recent research from Duke University

highlighted that limiting how often content can be shared and to how many people could limit the spread of misinformation.⁸⁸ We hope our study can prompt more research on the sources of misinformation within the research community, and what can be done to limit its spread while respecting freedom of speech. Beyond this, participants of the Global Expert Panel suggested pushing for more specific research on social media use amongst the research community to better understand the specific elements that have been most beneficial to countering misinformation and bettering public understanding of research.

Recognising peer-review contributions

Peer review remains an important element of the research community’s confidence in research. Upholding the value of this will become increasingly important with so many demands being placed on researchers, the volume of research papers increasing, and mis- and disinformation on the rise. Our survey and discussions with researchers indicate

⁸⁵ Montgomery, M. (2020). Disinformation as a wicked problem: Why we need co-regulatory frameworks. Brookings

⁸⁶ World Health Organisation. (2020). Countering misinformation about COVID-19. WHO

⁸⁷ Misinformation Review. (2021). Research note: Examining how various social media platforms have responded to COVID-19 misinformation. Harvard Kennedy School

⁸⁸ Jackson, M et al. (2022). Learning through the grapevine and the impact of the breadth and depth of social networks, PNAS, from <https://www.pnas.org/doi/abs/10.1073/pnas.2205549119>

that researchers are calling on institutions and universities to acknowledge their work as peer reviewers when assessing career progression. Participants of the Global Expert Panel flagged that this can be hard to keep track of—in part due to the anonymity of peer review—and in turn pointed to the importance of infrastructure. The example they cited was the ORCID platform⁸⁹, which was set up so that organisations can add peer review information

(both anonymous or open) to a researcher's record, which can be shared with funders, institutions, etc. Additionally, they outlined the importance of ensuring that the criteria for career recognition become more transparent and standardised. They cited the example of CRediT (Contributor Roles Taxonomy)⁹⁰, which was recently standardised to be made applicable to the STEM publication process in particular.^{91,92}

⁸⁹ <https://orcid.org/>

⁹⁰ <https://credit.niso.org/>

⁹¹ Fernandez-Patron, C & Hardy, E. (2018). A New Science Publishing System for a Budding Science Publishing Crisis. *Sci Eng Ethics*, 24(2), 805-808.

⁹² Cintas, P. (2016). Peer review: From recognition to improved practices. *FEMS Microbiology Letters*, 363(12), 1-4.

Building public trust and understanding

Our research suggests a need to ensure that this uptick in public attention translates into a legacy of greater public understanding of research and the research process. This will require proactive efforts and collaborations across different stakeholder groups.

Investing in public campaigns and bodies

Beyond scientific advisory institutions, researchers we engaged with stressed the importance of effectively engaging with the public. Policymakers, they feel, can play an important role in facilitating this. In the Netherlands, for instance, the Ministry of Education, Culture and Science launched the Dutch Research Agenda (NWA). In place since 2020, it funds science communication projects,⁹³ and in June 2022, pledged EUR10mn to make science communication more effective, calling for a national centre that contributes to confidence in science.⁹⁴ Similarly, in September

2020, the French government called for a “science and media network” as part of its 10-year science plan aimed at bringing scientists and journalists closer, and making scientific resources more easily available to the public.⁹⁵ Other countries have had these in place for while: Germany’s Wissenschaft im Dialog, for instance, has been in place since 2000;⁹⁶ and the UK’s National Co-ordinating Centre for Public Engagement (NCCPE) was founded in 2008.⁹⁷

Conducting research on research communication methods

The effective communication of research seems to be an increasingly important component of the research enterprise. Yet a common theme that emerged was the need for better communication rather than more communication. The researchers in our study are calling for communication training and communication intermediaries, but note that these have all been trialled before and are in

⁹³ *The Dutch Research Agenda funds innovative science communication.* (2022, January 27). NWO. Retrieved September 16, 2022, from <https://www.nwo.nl/en/news/dutch-research-agenda-funds-innovative-science-communication>

⁹⁴ *Ten million for better science communication.* (n.d.). Delta.TU Delft. Retrieved September 16, 2022, from <https://www.delta.tudelft.nl/ten-million-better-science-communication#>

⁹⁵ *French plan for improving science communication stirs up controversy.* (2020). Science.org. Retrieved September 16, 2022, from <https://www.science.org/content/article/french-plan-improving-science-communication-stirs-controversy>

⁹⁶ *Wissenschaft im dialog.* (n.d.). Wissenschaft Im Dialog. Retrieved September 16, 2022, from <https://www.wissenschaft-im-dialog.de/>

⁹⁷ *National Co-ordinating Centre for Public Engagement.* (n.d.). National Co-ordinating Centre for Public Engagement. Retrieved September 16, 2022, from <https://www.publicengagement.ac.uk/>

need of improvement. In this context, they are also calling for fresh research to be done on the communication of research.

Promoting awareness of key research terminology

There are a few key terms commonly used amongst the research community that may be less familiar or accessible to the public. Ten years ago, for instance, the term “peer review” was rarely featured in public discourse—be it media articles or policy discussions—but after efforts to mainstream the work, is now a feature of editorial policies and public service training.⁹⁸ The participants of the Global Expert Panel called on information providers (such as librarians), journals, other researchers and funders, to replicate these efforts for other terminology, like “preprint” or “predatory journal” to help the public understand the nuances of the research process, and the implications of these publications. For them, a campaign of sorts would involve collaborating with the media, social media platforms and policymakers. A greater awareness of common research terminology will also make it easier for the media and policymakers to communicate uncertainty to their audiences more effectively.

Valuing interdisciplinary approaches, while being mindful of the importance of expertise

A participant in the Global Expert Panel observed that “the consequences of the pandemic would have been better understood

by the public if the communication was not just from an epidemiological perspective but also recognised the socio-economic damage the pandemic was causing”. Embracing interdisciplinary approaches to research could therefore improve confidence in research across the research community and the public. However, some researchers also sounded a note of caution: “some unqualified researchers from other fields, for instance, physics, were talking professionally about Covid-19, although they were not experts. I think this ended up reflecting negatively on research institutions [and their role is disseminating good-quality information]”, says Dr Czesnick. Multiple perspectives and insights are valuable, but researchers who seek to work across disciplines must also maintain a measure of humility.

Spotlighting the societal impact of research

Given the volume of research out there, and the growing interest on behalf of researchers to influence policy and broader societal outcomes, the researchers we spoke to are calling on journals and publishers to better highlight the societal impact of research papers to make it easier for policymakers, journalists or the general public to identify relevant research. More specifically, participants at the Netherlands roundtable suggest integrating digestible summaries of how the research contributed to or intends to contribute to broader public impacts within or in addition to article abstracts.

⁹⁸ Wilson, J. (2015) So does the public finally ‘get’ peer review? Elsevier, from <https://www.elsevier.com/connect/so-does-the-public-finally-get-peer-review>

Preparing researchers for a public-facing role

Our research suggests that many researchers want to step into a more public-facing role but feel they need more time, support, training and guidance to do so. This will be crucial if researchers are to feel more confident in their ability to communicate effectively, tackle misinformation and, ultimately, influence policy and make an impact.

More time, less admin

In addition to their teaching and research responsibilities, researchers spend a lot of time on administrative tasks, be it ordering equipment or filling in grant applications. For many, these demands are a key barrier to bringing their research to the public and seeking to engage with different stakeholders. The researchers we spoke with are calling on universities to simplify administrative procedures, where possible, by delegating some responsibilities to dedicated individuals or administrative staff. This would give them more time to engage with the public more effectively.


Mentorship for early-career researchers

Mentorship relationships were impacted during the pandemic, leaving early-career researchers without the same opportunities to seek advice on methods, processes and difficulties.

According to the researchers we spoke with, these networks need to be rebuilt. More senior researchers—established and distinguished researchers—have a key role to play in maintaining these relationships and rendering them useful. A participant in our research noted that universities can also encourage this by recognising mentorship efforts as part of tenure assessments. “As early-career researchers try to develop their careers, they need to know how to do things. Sometimes they face dead ends and need assistance on how to move forward: be this, preparing applications or solving an equation. Mentorship relationships were disrupted during the pandemic. This generation of researchers learnt to be independent, but these relationships should still be maintained. If we had mentorship structures that went beyond institutions, and were much more integrated at the regional, continental or global levels, we could have a much more diverse environment in which to nurture relationships amongst scientists, regardless of their language or background”, says Dr Miranda-Nieto.

Formalising communications training

The results of our survey point to a clear demand for communications training (see Findings) and we received mixed reactions



“Research institutions should find a way to split communication and research responsibilities rather than mandating training and/or communication across the board.”

Dr Ayesha Siddiqi, University Lecturer at the Department of Geography at University of Cambridge; Council Member, Arts and Humanities Research Council (AHRC)

from the researchers we spoke and engaged with. Some researchers are calling for universities, funders and publishers to formalise communication training starting from the PhD level. This, they feel, will give researchers, especially early-career researchers the tools and guidance to communicate ethically and effectively. Here, researchers placed an emphasis on learning to communicate uncertainty and learning to communicate in “public-facing ways” to better align the confidence that researchers have in research with the confidence that the public has in research. The researchers we spoke with also highlighted the importance of social media here, which though a vehicle for online harassment, will continue to be an important communication avenue for the research community. Formalised communication training from early on in a researcher’s career will ensure that all researchers have the option to engage with the public. A notable example that we heard about in this context has been the public engagement programmes run by the American Association for the Advancement of Science (AAAS).⁹⁸ Other researchers, however, expressed some reservations about communications training. Participants in the Global Expert Panel, in particular, noted that

while it can make research more accessible, it is not clear if it improves public understanding in the long run. In this context, they emphasised the value of communications training for university and journal staff. They felt that this could build capacity more broadly, and possibly counter the issue of wealthier institutions dominating public attention because they have the means to rather than necessarily because they’re doing the best or most relevant research.

Establishing communication intermediaries

All researchers should have the tools and opportunities to get their research out to the world, but not all want to or feel confident enough to shoulder this expectation by themselves. “Some academics are better at science communication than others. A specialisation model where certain people would focus on communication while stepping away from other responsibilities would work better than a mainstream framework. Research institutions should find a way to split communication and research responsibilities rather than mandating training and/or communication across the board”,

⁹⁸ AAAS. Public Engagement, from <https://www.aaas.org/focus-areas/public-engagement>

says Dr Siddiqi. Where absent, researchers are calling on universities to hire formal science communicators to act as knowledge management bodies that can help funnel requests from policymakers to the relevant researchers, and vice versa. Where present, the researchers we spoke with felt that science communicators were insufficiently prepared for emergencies. For them, a key learning from this pandemic was to improve the function of these bodies by ensuring that they connected experts with the media and policymakers even in “normal” times. According to a participant in the German roundtable “communication cannot be restricted or controlled so we need institutions to ensure that the results we need get to the right places and are translated in such a way that people and systems can use them.” They cited the Science Media Centre⁹⁹—an independent press office for science in the UK—as an example of an initiative to replicate.

Providing support in the face of online abuse

Online interactions are becoming more commonplace amongst researchers, and our survey results suggest that early-career researchers will push this trend further. While a safe online environment cannot be guaranteed, some researchers we engaged with felt unsupported by institutions in the

face of online abuse. With this in mind, they felt that universities should draft clear codes of conduct on how to manage online abuse, and make clear how they intend to protect and support researchers. Researchers who took part in the US roundtable even called for rewards for dealing with the abuse, rather than punishments, citing instances where they were professionally punished for standing their ground.

Formalising science advisory institutions

During the pandemic, many governments established “ad-hoc scientific committees” to help deal with the crisis.¹⁰⁰ One such example is efforts by the National Academies of Sciences, Engineering, and Medicine in the US to convene an ad-hoc committee—sponsored by the National Science Foundation—that seeks to understand and address misinformation about science.¹⁰¹ The researchers we spoke with are calling for these sorts of efforts to continue, even into “normal” times. Participants at the Netherlands roundtable referred to this as promoting “a good governance of evidence” that would enable government and policymakers to liaise with experts consistently, quickly and strategically, and ensure that scientists, researchers and scholars have formalised access to policy circles.

⁹⁹ Science Media Centre. <https://www.sciencemediacentre.org/>

¹⁰⁰ UNESCO Science Report: The race against time for smarter development. United Nations

¹⁰¹ National Academies. Understanding and Addressing Misinformation about Science, from <https://www.nationalacademies.org/our-work/understanding-and-addressing-misinformation-about-science#sectionProjectScope>

Tackling inequality

The results of our survey suggest that the pandemic had a disproportionate impact on researchers in the Global South. We heard researchers call for continued efforts to direct research funding to and support research contributions from countries and research communities faced with “chronic underfunding”.¹⁰²

Making room for non-English speakers

Adding to this, Dr Miranda-Nieto, postdoctoral fellow at OsloMet, encourages us to look at the degree to which the research community leaves room for local-specific perspectives in different languages. This, he feels, is key to what he calls a “plural system” for science and research that makes room for different perspectives. “Ultimately, science is communicated, thought, read and written in English, which makes it more difficult for non-English-speaking researchers to play a role in broader policy discussions. Going forward, will collaboration and communication allow for different languages? Is it really meaningful for findings to be communicated in

English, just to publish in big journals, without then reaching the right audience? There is this assumption that going global means using English, especially in STEM disciplines. But there are some instances, especially in social sciences, where findings are locally-specific and should be communicated in local languages so that they benefit and are accessible to the relevant audience”.

Incentivising cross-regional collaborations

The pandemic resulted in what some researchers have called “scientific nationalism” and collaborations involving fewer nations and smaller teams.¹⁰³ During the roundtables in the UK and the Netherlands, in particular, researchers voiced their concerns around this and the pressures researchers faced to promote research that came from their own country. This, they felt, would also have implications for the degree to which the voices and perspectives of their colleagues in the Global South could be properly represented. In this context, the researchers we spoke with are calling on the

¹⁰² UNESCO Science Report: The race against time for smarter development. United Nations

¹⁰³ Cai, X, Fry, CV & Wagner, CS. (2020). International Collaboration During the COVID-19 Crisis: Autumn 2020 Developments Available at SSRN: <https://ssrn.com/abstract=3729672> or <http://dx.doi.org/10.2139/ssrn.3729672>.



“We have to keep working towards a future where even when the money is coming from somewhere, that doesn’t mean that all the knowledge and the intellect is coming from there too.”

Dr Ayesha Siddiqi, University Lecturer at the Department of Geography at University of Cambridge; Council Member, Arts and Humanities Research Council (AHRC)

broader research community in the Global North to support cross-regional collaborations that can level the knowledge playing field.

In the UK, for instance, funding bodies have been offering funding opportunities that are based on joint investigations, requiring that one of the leading researchers is based in the Global South. Additionally, some are offering international grants to researchers in the Global South directly instead of sending Global North researchers to do their research there.¹⁰⁴ But there is a need for a systematic assessment to better understand what is working (and what is not) and account for the long-term impacts

on researchers in the Global South. For Dr Siddiqi, university lecturer at the University of Cambridge, this also entails finding ways to value different ways of knowing. “It is not just about supporting the Global South with some kind of patronage-based relationship. There are different ways of knowing things, and on a lot of things, colleagues in the Global South have a lot more knowledge. We have to keep working towards a future where even when the money is coming from somewhere, that doesn’t mean that all the knowledge and the intellect is coming from there too. There is a lot to be done so that colleagues from the Global South can interact on equal terms”.

¹⁰⁴ Flint, A et al. (2022). Equity in Global North–South research partnerships: interrogating UK funding models, *Global Social Challenges Journal*, 1(1), 76-93. Retrieved Oct 4, 2022, from <https://bristoluniversitypressdigital.com/gsc/view/journals/gscj/1/1/article-p76.xml>

Technical Appendix A: Research Methodology and Approach



Economist Impact's research was based on the following components: a literature review, an independent Advisory Board, a survey of researchers globally and in-depth interviews. Additionally, Economist Impact observed and drew insights regarding interventions from six regional roundtables with researchers and a Global Expert Panel organised by Elsevier and its regional partners. We outline here the key methodological details and considerations for each of these activities.

I. Literature review

The first phase of the research consisted of a rapid pragmatic literature review aimed at understanding the existing research and debates relevant to confidence in research. A search was performed in the following databases: PubMed, EMBASE, Scopus, Google Scholar and the Directory of Open Access Journals using the search terms "research integrity", "confidence in science", "scientific integrity", "scientists' integrity", "scientists' trust", "ethics scientists" and "truth disclosure". This was backed up by additional grey literature searches of publications by professional bodies including the Organisation for Economic Co-operation and Development (OECD), the International Science Council and All European Academies (ALLEA). Articles were limited to the English language and published in the last five years. Public and citizen's trust in science and research were excluded as not in scope.

The search produced 5,957 results of which 1,553 were duplicates. An initial review at title and abstract level resulted in 361 relevant references, of which 204 were included in our review.

Themes were considered within the framework of the following four domains:

- Domain 1: How does the scientific process applied by scientists affect research integrity and confidence?
- Domain 2: How does the availability of scientific resources, tools and skills for scientists affect research integrity and confidence?
- Domain 3: How does science communication by scientists affect research integrity and confidence?
- Domain 4: How do short-term and long-term drivers affect research integrity and confidence?

Economist Impact produced a 17,000-word literature review outlining the key themes. The themes identified in the literature review were then used to inform the design of a survey questionnaire, which was shared with our independent Advisory Board for review and critique.

II. Advisory Board

To provide guidance and constructive feedback, and to validate our approach, Economist Impact convened an independent Advisory Board of scientists, scholars and researchers. Advisory Board members were selected to ensure representation across different regions, fields of expertise, and career stages. We also sought to ensure representation from universities, international organisations, editors and NGOs. The members of our Advisory Board included:

- **Dr Agnes Binagwaho**, Vice-Chancellor, University of Global Health Equity, Rwanda
- **Dr Cary Funk**, Director of Science and Society Research, the Pew Research Center
- **Dr John Grove**, Director of Quality Assurance for Norms & Standards, World Health Organisation
- **Dr Heide Hackmann**, Senior Advisor for Transdisciplinarity and Global Knowledge Networks, Centre for the Advancement of Scholarship of the University of Pretoria and Interim Director for Future Africa.

- **Dr Richard Horton**, Editor-in-chief, *The Lancet*
- **Dr Reiko Kuroda**, Professor at Chubu University, Japan and Professor Emeritus at The University of Tokyo
- **Dr Nick Perkins**, Board Member of International Science Council
- **Dr John Pham**, Editor-in-chief, *Cell*
- **Dr Wim van Saarloos**, Chair of the Energy Programme, European Academies Science Council (EASAC); Professor of theoretical physics, the Instituut-Lorentz, University of Leiden
- **Dr Michael Saliba**, Professor & Director of the Institute for Photovoltaics (ipv), Stuttgart University
- **Dr Karla Soares-Weiser**, Editor-in-chief, Cochrane Library
- **Dr Jack Stilgoe**, Professor of Science and Technology Policy, Dept of Science & Technology Studies, Faculty of Maths & Physical Sciences, University College London

The Advisory Board was convened in March 2022 for a three-hour meeting. Two Elsevier representatives attended the Advisory Board meeting as observers and did not take part in the discussion. Prior to the meeting, Economist Impact shared a project outline and draft version of the survey questionnaire. Following the meeting, Economist Impact revised the survey questionnaire and circulated a final draft to Advisory Board members. While the Advisory Board members provided important feedback and input, the final survey questionnaire and the research should not be taken as reflective of their views or endorsement. All errors and omissions remain Economist Impact's responsibility alone.

III. Survey

Following our literature review and engagement with experts on the topic of the research, Economist Impact identified a number of areas for exploration including attitudes of researchers on their role in society, the impact of increased public and policymaker attention on research, and the communication of research findings online.

With regard to increased public attention, we aimed to capture the extent to which research is now presented and discussed in public fora, including social media; the extent to which research is published earlier in the process, in preprint form and before peer review; the extent to which media outlets pick up on and report scientific research; the extent to which policymakers are engaging with the scientific research community to devise and defend policy; and the extent to which the public is more aware of and has an opinion on the practice of science and the findings of research.

Our survey was thus seeking to answer questions such as:

- What impact does increased public attention have on how researchers view their role in society?
- What impact does increased public attention have on the research process and researcher perceptions of the research process?
- What impact does increased public attention have on the ways in which researchers communicate their findings in public?
- What resources, support or guidance do researchers need to effectively navigate increased public attention on scientific research?

Our working hypothesis was that a significant majority of researchers believe that the

pandemic has increased public attention on science and research. Before the pandemic, social media provided opportunities for scientists to share their research more openly and engage with a wider diversity of research across disciplines and regions. It was allowing science to happen more out in the open, inevitably making it more subject to debate, criticism and misinterpretation. Our hypothesis, based on our review of existing research, was that the pandemic accelerated this. On the one hand, increased public attention on science provides opportunities for evidence-led policymaking, increased scientific collaboration and innovation, and educating the public on the process and content of scientific research. But on the other, it brings challenges.

Increased public attention on research may be leading to changes in behaviour and practice among the research community—speeding up research, encouraging or even pressuring researchers to publish their research earlier, sometimes before peer review. Increased speed can be a good thing, but not if it comes at the expense of quality. Particularly for fields of science that are more likely to feature in the mainstream media, or where there is greater interest from non-expert citizens, scientists may be more likely to consider public opinion when conducting research. We hypothesise that they may also be more likely to consider public opinion when communicating research findings, potentially leading to self-censorship or an unwillingness to step away from conclusions for fear of backlash or reputation loss. We also hypothesised that a sizable proportion of the research and scientific community are concerned about these trends and would welcome interventions to tackle these issues, as few resources are currently available.

To test these hypotheses, Economist Impact undertook a survey of the scientific research community. With a target sample size of 3,000 researchers, we surveyed researchers globally across different fields of expertise and different stages of their career. To obtain as representative a sample as possible, we utilised Elsevier's Scopus database, which includes over 17 million researchers globally, to draw the sample for the survey. Our criteria was that survey respondents had to be currently active in research and have published research within the past three years.

The survey was programmed and disseminated using a software platform called Confirmit (part of the Forsta brand) and an online link was sent to potential respondents inviting them to participate in the survey. The questionnaire was designed to prevent bias and was structured to ensure there was a natural flow to the questions to make it easy for a respondent to navigate. The survey was sent by Elsevier but was Economist Impact branded and included a clear description that Elsevier was the sponsor of the research. All aspects of the survey process were conducted in a manner to ensure full compliance with data protection requirements. The survey was disseminated in English and Mandarin. The survey consisted of 19 content questions and six demographic questions (see Technical Appendix B for the full list of questions). Survey respondents did not receive an incentive. The fieldwork took place between 17 May 2022 and 19 July 2022.

In total, 3,144 researchers responded to the survey. The response rate was 0.8% (excluding non-delivered emails). This is lower than previous surveys utilising Scopus, where the response rate was 1-3%.¹⁰⁵ Given this low

¹⁰⁵ See for example, Elsevier and Sense about Science. (2019). Quality, Trust and Peer Review: Researchers' Perspectives 10 years on, available at: <https://senseaboutscience.org/wp-content/uploads/2019/09/Quality-trust-peer-review.pdf>

response rate, it is important to emphasise that our research should be seen as indicative and directional rather than in any way representative of the scientific/researcher community. The survey took a respondent an average of 19 minutes to complete. We believe that the low response rate, relative to previous surveys using Scopus, could be due to the length of the survey, the absence of an incentive, suspected increased survey invitations going into junk email, an increased volume of researchers invited to reach quotas on specific countries and the lack of brand recognition given that Economist Impact is a new brand (we do mention our sister organisation, *The Economist* newspaper, in the survey introduction text).

Weighting

Participants were recruited across n=111 countries (for details on the response breakdown by country, please contact a member of the Economist Impact team). As participation in the survey was voluntary, the number of completes in each country varied. To achieve a global average that was reflective of the population of researchers, we weighted responses at the regional level against data on researchers per million inhabitants (full-time equivalent) from the UNESCO Institute for Statistics (UIS) database on the global researcher population.¹⁰⁶ We aligned our weighting with the following breakdown of the researcher population: APAC = 36% (of the global researcher population), Europe and MEA = 32% and North America and LATAM = 31%.

Despite the weighting, the study is not without limitations due to self-selection, non-response biases and the lower response rate than is typical for online surveys of this nature. Therefore, there will be some non-sampling error associated with this study, as we cannot be sure responses accurately represent the views of the population for a given country. Statistical differences shown in this report should be interpreted within this context, and while showing notable differences between groups, results are not necessarily generalisable to a whole country. Given the non-probability sampling methods, these tests are indicative. The base sizes included in the report are unweighted unless otherwise stated. The exception here is data at the regional level, where assessments took place using weighted data to facilitate more representative comparisons across regions.

Statistical testing

Survey results were tested to establish the statistical significance of results for sample mean differences by region, gender, sector and some other background variables at 95% confidence level. Results by field of expertise were not tested for statistical significance as the way the questions were structured—enabling the selection of multiple options—did not allow for this.

Demographic breakdown of survey respondents

Below, we provide a demographic breakdown of our survey respondents, however, for full details on the survey data, please refer to the separate findings slide deck.

¹⁰⁶ UNESCO Institute for Statistics (2022). <http://data.uis.unesco.org/>

Demographic breakdown of survey respondents*

| | North America | Latin America | Europe | Asia Pacific | Middle East and Africa |
|---------------------------|---------------|---------------|--------|--------------|------------------------|
| Total number of responses | 340 | 218 | 1024 | 1392 | 170 |
| Weighted number | 849 | 126 | 817 | 1163 | 189 |

* For details on the response breakdown by country, please contact a member of the Economist Impact team who wrote this report.

Response breakdown by gender

| Gender | Number of responses (unweighted) |
|-------------------------------------|----------------------------------|
| Man | 2097 |
| Woman | 905 |
| Non-binary | 30 |
| Something else (specify if desired) | 11 |
| Prefer not to say | 101 |

Response breakdown by career stage

| Career stage | Number of responses (unweighted) |
|---|----------------------------------|
| Early-career researcher (undertaking a PhD) | 548 |
| Recognised researcher (Post-Doc, tenure track professor) | 643 |
| Established researcher (e.g. assistant professor, professor, senior lecturer, reader) | 1179 |
| Distinguished researcher (research group leader, department head or chair, tenured, emeritus professor) | 569 |
| Something else, please specify | 205 |

For the purposes of analysis, this was further categorised into the following:

| Survey career stage | Career stage group |
|---|--------------------------|
| Early-career researcher (undertaking a PhD) | Early-career researcher |
| Recognised researcher (Post-Doc, tenure track professor) | Early-career researcher |
| Established researcher (e.g. assistant professor, professor, senior lecturer, reader) | Established researcher |
| Distinguished researcher (research group leader, department head or chair, tenured, emeritus professor) | Distinguished researcher |

Response breakdown by field of expertise (respondents were given the option to select all that apply)

| Field of expertise (select all that apply) | Number of responses (unweighted) |
|---|----------------------------------|
| Engineering and Technology | 483 |
| Medicine and Allied Health | 468 |
| Social Science | 374 |
| Biological Sciences | 358 |
| Computer Sciences / IT | 318 |
| Environmental Sciences | 288 |
| Physics | 233 |
| Biochemistry, Genetics, and Molecular Biology | 219 |
| Agriculture | 192 |
| Materials Science | 181 |
| Economics | 180 |
| Mathematics | 171 |
| Chemistry | 168 |
| Arts and Humanities | 157 |
| Earth and Planetary Sciences | 144 |
| Psychology | 141 |
| Business, Management and Accounting | 133 |
| Neuroscience | 131 |
| Energy | 116 |
| Electrical / Electronic Engineering | 113 |
| Pharmacology, Toxicology and Pharmaceutics | 104 |
| Immunology and Microbiology | 103 |
| Chemical Engineering | 70 |
| Decision Sciences | 50 |
| Astronomy | 48 |
| Veterinary Medicine/Science | 42 |
| Nursing | 36 |
| Dentistry | 17 |
| Other (please specify) | 285 |
| None of these | 14 |

For the purposes of analysis, these 27 disciplines were further sorted into eight fields of expertise that were categorised based on UNESCO categories. The categorisation was as follows:

| Field of expertise (as per survey) | Relevant UNESCO category |
|---|---|
| Engineering and Technology | Engineering, Manufacturing and Construction |
| Medicine and Allied Health | Health and Welfare |
| Social Science | Social Sciences, Journalism and Information |
| Biological Sciences | Natural Sciences, Mathematics and Statistics |
| Computer Sciences / IT | Information and Communication Technologies |
| Environmental Sciences | Natural Sciences, Mathematics and Statistics |
| Physics | Natural Sciences, Mathematics and Statistics |
| Biochemistry, Genetics, and Molecular Biology | Natural Sciences, Mathematics and Statistics |
| Agriculture | Agriculture, Forestry, Fisheries and Veterinary |
| Economics | Social Sciences, Journalism and Information |
| Materials Science | Engineering, Manufacturing and Construction |
| Arts and Humanities | Arts and humanities |
| Mathematics | Natural Sciences, Mathematics and Statistics |
| Chemistry | Natural Sciences, Mathematics and Statistics |
| Earth and Planetary Sciences | Natural Sciences, Mathematics and Statistics |
| Psychology | Social Sciences, Journalism and Information |
| Business, Management and Accounting | Business, Administration and Law |
| Neuroscience | Health and Welfare |
| Electrical / Electronic Engineering | Engineering, Manufacturing and Construction |
| Energy | Engineering, Manufacturing and Construction |
| Pharmacology, Toxicology and Pharmaceutics | Health and Welfare |
| Immunology and Microbiology | Health and Welfare |
| Chemical Engineering | Engineering, Manufacturing and Construction |
| Astronomy | Natural Sciences, Mathematics and Statistics |
| Decision Sciences | Social Sciences, Journalism and Information |
| Veterinary Medicine/Science | Agriculture, Forestry, Fisheries and Veterinary |
| Nursing | Health and Welfare |
| Dentistry | Health and Welfare |

As a result, we ended up with the following response breakdown by field of expertise:

| Field of expertise (UNESCO categories) | Number of responses (unweighted) |
|---|----------------------------------|
| Natural Sciences, Mathematics and Statistics | 1028 |
| Health and welfare | 731 |
| Engineering, Manufacturing and Construction | 725 |
| Social Sciences, Journalism and Information | 642 |
| Information and Communication Technologies | 318 |
| Agriculture, Forestry, Fisheries and Veterinary | 221 |
| Arts and humanities | 157 |
| Business, Administration and Law | 133 |

Response breakdown by race

| Race (select all that apply) | Number of responses (unweighted) |
|---|----------------------------------|
| White | 1387 |
| Asian or Pacific Islander | 1068 |
| Black | 125 |
| Hispanic or Latino/a/x | 121 |
| Middle Eastern or North African | 73 |
| Indigenous (e.g. North American Indian Navajo, South American Indian Quechua, Australian Aborigine) | 30 |
| Other (please specify) | 116 |
| Prefer not to say | 289 |

Response breakdown by ethnic origin

| Ethnic origin (select all that apply) | Number of responses (unweighted) |
|--|---|
| Western Europe (e.g. UK, Germany, Greece) | 999 |
| East and Central Asia (e.g. China, Japan, Uzbekistan) | 776 |
| South and Southeast Asia (e.g. India, Indonesia, Singapore) | 376 |
| North America (Canada, US) | 287 |
| Eastern Europe (e.g. Russia, Poland, Hungary) | 220 |
| South America (e.g. Colombia, Brazil, Chile) | 131 |
| Sub-Saharan Africa (e.g. Nigeria, Kenya, South Africa) | 131 |
| West Asia / Middle East (e.g. Israel, Saudi Arabia, Iran) | 108 |
| Central America and Caribbean (e.g. Mexico, Panama, Jamaica) | 47 |
| Pacific / Oceania (e.g. Australia, Papua New Guinea, Fiji) | 27 |
| North Africa (e.g. Morocco, Egypt, Sudan) | 22 |
| Other (please specify) | 78 |
| Prefer not to say | 180 |

Response breakdown by organisation

| Organisation | Number of responses (unweighted) |
|--------------------------------|---|
| University | 2110 |
| Research institute | 353 |
| Hospital / medical school | 209 |
| Commercial / corporation | 124 |
| Government | 92 |
| College | 76 |
| Something else, please specify | 144 |
| Prefer not to say | 37 |

IV. Qualitative interviews

We also undertook a series of in-depth, semi-structured interviews with nine researchers, science communicators, and editors. The aim of these interviews was to hear about the impacts of the pandemic from researchers in different countries, career stages and contexts, contextualise the results of our survey, and receive recommendations about possible interventions and solutions. The full list of interviewees are:

- **Dr Hjördis Czesnick**, Head of office, the German Research Ombudsman
- **Dr Sarah Iqbal**, Science engagement consultant, Foundation for Advancing Science and Technology (FAST India)
- **Dr Francis Kombe**, CEO, EthiXPert, NPC-SA, Wellcome Trust funded DPhil student at the School of Applied Social Sciences (Psychology); University of KwaZulu-Natal (UKZN)
- **Dr Ayumi Koso**, Director of NBRP Public Relations Office, National Institute of Genetics, Japan
- **Dr Alejandro Miranda-Nieto**, Postdoctoral Fellow, Faculty of Social Sciences, Department of Social Work, Child Welfare and Social Policy, Living Conditions, Health, Work and Social Inequalities, OsloMet
- **Dr Jose Mustre de Leon**, Director, Centre for Research and Advanced Studies (Cinvestav), Mexico
- **Dr Job Mwaura**, Research Fellow at Stellenbosch University in South Africa
- **Dr Ayesha Siddiqi**, University Lecturer at the Department of Geography at University of Cambridge; Council Member, Arts and Humanities Research Council (AHRC)

- **Dr Deborah Zarin**, Program Director, Advancing the Clinical Trials Enterprise at MRCT Center of Brigham's and Women's Hospital and Harvard University

V. Identifying interventions: Elsevier-led regional roundtables and global expert panel

To explore potential interventions that could help to support the research community in navigating this new landscape, Elsevier partnered with six science/research-focused organisations to chair and deliver a series of regional roundtable discussions. These discussions were held in the Netherlands, UK, US, Japan, Germany and China between 4th July and 8th September. At each of these roundtables, Economist Impact presented interim findings from the survey and then observed the remaining discussion. Relevant insights from these roundtable discussions were then selected by the Economist Impact team and included in this report in the final 'Implications and Takeaways' chapter.

Additionally, Elsevier selected and convened a Global Expert Panel to provide feedback and input on interventions and recommendations to support researchers, particularly early-career researchers. The Global Expert Panel was chaired by Sense About Science and included members of Economist Impact's Advisory Board, plus additional stakeholders selected and convened by Elsevier. As with the regional roundtables, Economist Impact's role in the Global Expert Panel meeting was limited to a presentation of the research findings and then observation of the discussion. Economist Impact had sole editorial control and responsibility over what insights from the roundtables and Global Expert Panel are included in the report.

Technical Appendix B: Full list of survey questions



This 15-minute survey has been designed by The Economist Group's in-house think tank, Economist Impact. The research is supported by Elsevier. The survey seeks to understand researchers' confidence in the practice of undertaking and communicating research and how this has been impacted by the pandemic. Topics in this survey include the attitudes of researchers on their role in society, the impact of increased public and policy maker attention on research, and the communication of research findings online.

Screener question

How would you best describe the stage of your research career? Please select one

- a. Not currently active in research - EXIT
- b. Early career researcher (undertaking a PhD)
- c. Recognised researcher (Post-Doc, tenure track professor)
- d. Established researcher (e.g. assistant professor, professor, senior lecturer, reader)
- e. Distinguished researcher (research group leader, department head or chair, tenured, emeritus professor)
- f. Something else, please specify _____

Content questions

1. **When you are considering whether to cite or share someone else's research, which of the following are most important in terms of giving you confidence that their findings are reliable. Select the top three in order of importance**
 - a. The design of the research methodology
 - b. Accessibility of data used in the study
 - c. The lead researcher's reputation
 - d. The source of funding behind the research
 - e. The institution the researchers are affiliated with
 - f. Whether the research is published in a peer reviewed journal
 - g. The research has been highly cited by other researchers
 - h. It is available in a permanent archive (e.g. not on a personal website, blog, forum)
 - i. Something else, please specify _____

2. To what extent do you feel confident in your ability to....

| | Completely confident | Fairly confident | Somewhat confident | Slightly confident | Not confident at all |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Design replicable research methods | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Explain research methods publicly | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Communicate research findings on social media | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Communicate research findings to policy makers | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Communicate research findings to journalists | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

3. How much do you agree or disagree that the following would contribute to improving researchers' confidence in assessing the reliability of others' research?

| | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree | Don't know/ not applicable |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|----------------------------|
| There are indicators that demonstrate the societal and economic impact of the research | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The research shows evidence of inclusion and diversity | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| It is made clear that the research has been subject to protocols to address research error, unethical behaviour and fraud. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Readers (identifiable researchers) are allowed to post comments and engage with the author alongside the published article | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Communicate research findings to journalists | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

3a. What other changes in tools and procedures do you think would be most useful to help increase confidence in the reliability or integrity of research in your discipline? COMMENT BOX (optional)

4. To what extent do you agree or disagree with the following statements regarding the impact of the pandemic on researchers? Please select one in each row

| | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree | Don't know/ not applicable |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|----------------------------|
| The research community responded well to the challenges of the pandemic. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The pandemic has shown the importance of making research available quickly as preprints before peer review. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The pandemic increased the importance of separating good quality research from misinformation. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The pandemic increased the importance of science bodies and researchers explaining research findings to the public. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

5. Aside from generating new knowledge within a particular field or discipline, which of the following are part of your role as a researcher today? Please select the top two most important in your view

- a. Educate others about my field or discipline
- b. Enable innovation
- c. Publicly counter false or misleading information on topics I am knowledgeable about d. Solve political, social, economic or environmental problems
- d. Something else, please specify _____

6. And which of the following were a part of your role as a researcher before the pandemic? Please select the top two most important in your view

- a. Educate others about my field or discipline
- b. Enable innovation
- c. Publicly counter false or misleading information on topics I am knowledgeable about d. Solve political, social, economic or environmental problems
- d. Something else, please specify _____

7. To what extent do you agree or disagree with the following statements regarding the impact of the pandemic on research funding? Please select one in each row

| | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| The pandemic exacerbated inequalities in terms of access to funding and resources for research in my field. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The pandemic increased the influence that funders have over the selection of research topics. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The pandemic increased the influence that funders have over the findings of research. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

8. Is there anything else you would like to mention about the impact of the pandemic on the research community? COMMENT BOX (optional)

9. Describe the level of interest you think the following groups have in your field of research

| | A lot of interest | Some interest | A little interest | No interest |
|---------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Policymakers / government | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The general public | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The media | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Corporations | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

10. To what extent do you agree or disagree with the following statements. Please select one in each row

| | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| The pandemic has increased public attention and scrutiny on research in general | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The pandemic has increased public attention and scrutiny on research in my field of expertise | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| One legacy of the pandemic will be increased scrutiny in how research is conducted | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| One legacy of the pandemic will be better public understanding of the research and peer review process | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

11. What do you see as the main benefits from increased public attention on research? Please select the top three

- a. Influence on policy making
- b. Public involvement or knowledge
- c. More funding for research
- d. Greater profile for researchers
- e. Better quality research
- f. More ethically sound research
- g. Opportunity to improve social outcomes
- h. None of the above
- i. Something else, please specify _____

12. What do you see as the main challenges from increased public attention on research? Please select the top three

- a. Oversimplification of complex research
- b. Lack of public understanding about how research is conducted
- c. Politicisation of research
- d. Increased scrutiny of researchers' funding
- e. Extra time commitments from researchers
- f. Increased demands for open science without extra resources
- g. Increased risk of bullying and/or harassment
- h. None of the above
- i. Something else, please specify _____

13. What do you think are the main determinants of whether research in a relevant subject is used by policy makers (for example, government ministers or representatives from international organisations like the UN) ? Please select the top three

- a. the reputation of the journal it is published in
- b. the quality of the study design
- c. the institutional affiliation of the researcher
- d. whether the research is novel or ground breaking
- e. the communication skills of the researcher
- f. the researcher's profile on media or social media
- g. the personal connections that the researcher has with policy makers
- h. Something else, please specify _____

14. Has researchers' experience of the pandemic made you more or less inclined to do the following? Please select one in each row

| | Highly inclined | Somewhat inclined | Neither inclined nor disinclined | Somewhat disinclined | Highly disinclined |
|---|-----------------------|-----------------------|----------------------------------|-----------------------|-----------------------|
| Share your raw data | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Share your findings before peer review | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Share results that call into question your past work | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Ensure your research is peer reviewed | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Communicate uncertainty and caveats of your research | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Involve people outside of your immediate research field in shaping your research | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Select research that align with topics of public interest or current events | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Share your opinion on social, political, economic or environmental issues on social media | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Avoid controversial controversial topics when communicating your research | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

15. Which of the following do you think should be most important when it comes to being recognised and rewarded by your institution? Select the top three

- a. The number of articles published in peer reviewed journals
- b. The number of citations your research receives in peer reviewed journals
- c. Commitment to teaching
- d. Communicating your research in person (at conferences, events)
- e. Profile and level of activity online
- f. The number of mentions / appearances in mainstream media
- g. Your involvement as a peer reviewer of other's research
- h. Whether your research has influenced or been cited by policy makers
- i. Something else, please specify _____

16. Which of the following are most important when it comes to being recognised and rewarded by your institution? Select the top three

- a. The number of articles published in peer reviewed journals
- b. The number of citations your research receives in peer reviewed journals
- c. Commitment to teaching
- d. Communicating your research in person (at conferences, events)
- e. Profile and level of activity online
- f. The number of mentions / appearances in mainstream media
- g. Your involvement as a peer reviewer of other’s research
- h. Whether your research has influenced or been cited by policy makers
- i. Something else, please specify _____

17. To what extent do you agree or disagree with the following statements about engaging in discussions about science and research online or on social media? Please select one in each row

| | Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| I enjoy it | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I feel a responsibility to do it | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| It is essential to develop my reputation in my field | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I feel pressure to engage in conversations about research online from my university or other funders | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I tend to engage primarily with other researchers online | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I tend to engage with both researchers and people without an academic background online. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

18. Have you or close colleagues experienced any of the following after posting about research online? Select all that apply.

- a. Abusive private communications (emails, direct messages or texts)
- b. Abusive public communications (comments)
- c. Acrimonious debate on a public platform
- d. Something else, please specify _____
- e. I have not experienced these behaviours, nor am I aware of close colleagues who have

Respondents to Question 18 above who select answer choices ‘a - c’, proceed to Question 18b. All other respondents proceed to Question 19 directly.

- 18b. **You selected an answer choice that included abusive or acrimonious interactions online, how would you characterise what happened? Select all that apply**
- It was a fair critique, but the tone was aggressive.
 - It was an unfair critique or misrepresented the research.
 - It was a personal attack and had nothing to do with the substance of the research.
 - It was due to differences over politics and policy and had nothing to do with the substance of the research.
 - I do not know the details.
 - Something else, please specify _____
19. **Which of the following are most important when it comes to being recognised and rewarded by your institution? Select the top three**
- Communications training
 - Communication guidelines
 - More opportunities for engagement with news media
 - More opportunities for engagement with policymakers
 - More opportunities for engagement with industry
 - Support in the face of bullying, trolling or harassment
 - Something else, please specify _____

Demographic/screening questions:

Thank you for all your responses so far, you are nearly at the end of the survey. We'd also like to learn a little about you.

20. **In which country are you based?**

21. **Which one of the following broad subject disciplines do you specialise in?**

| | |
|---------------------------------------|------------------------------|
| Agriculture | Engineering and Technology |
| Arts and Humanities | Environmental Sciences |
| Astronomy | Immunology and Microbiology |
| Biochemistry, Genetics, and Molecular | Materials Science |
| Biology | Mathematics |
| Biological Sciences | Medicine and Allied Health |
| Business, Management and Accounting | Neuroscience |
| Chemical Engineering | Nursing |
| Chemistry | Pharmacology, Toxicology and |
| Computer Sciences / IT | Pharmaceutics |
| Decision Sciences | Physics |
| Dentistry | Psychology |
| Earth and Planetary Sciences | Social Science |
| Economics | Veterinary Medicine/Science |
| Electrical / Electronic Engineering | None of these |
| Energy | |

22. **In what year were you born?**
- a. (1981-2000)
 - b. (1965 - 1980)
 - c. (1946 - 1964)
 - d. (1945 or earlier)
 - e. Prefer not to say
23. **How would you describe the organisation you work for?**
- a. University
 - b. Research institute
 - c. Hospital / medical school
 - d. Commercial / corporation
 - e. Government
 - f. College
 - g. Something else, please specify _____
 - h. Prefer not to say
24. **What of the following best describes your Ethnic Origin(s)? Please select all that apply**
- a. Eastern Europe (e.g. Russia, Poland, Hungary)
 - b. Western Europe (e.g. United Kingdom, Germany, Greece)
 - c. North Africa (e.g. Morocco, Egypt, Sudan)
 - d. Sub-Saharan Africa (e.g. Nigeria, Kenya, South Africa)
 - e. West Asia / Middle East (e.g. Israel, Saudi Arabia, Iran)
 - f. South and Southeast Asia (e.g. India, Indonesia, Singapore)
 - g. East and Central Asia (e.g. China, Japan, Uzbekistan)
 - h. Pacific / Oceania (e.g. Australia, Papua New Guinea, Fiji)
 - i. North America (Canada, United States)
 - j. Central America and Caribbean (e.g. Mexico, Panama, Jamaica)
 - k. South America (e.g. Colombia, Brazil, Chile)
 - l. Other (please specify) _____
 - m. Prefer not to say
25. **How do you identify yourself in terms of Race? Please select all groups that apply**
- a. Asian or Pacific Islander
 - b. Black
 - c. Hispanic or Latino/a/x
 - d. Indigenous (e.g. North American Indian Navajo, South American Indian Quechua, Australian Aborigine)
 - e. Middle Eastern or North African
 - f. White
 - g. Other (please specify) _____
 - h. Prefer not to say
26. **Do you have anything to say about this survey or the topics covered in this survey? (optional)**

References



- Abdi, S et al. (2021). Educating PhD Students in Research Integrity in Europe. *Science and Engineering Ethics*, 27.
- Agoramoorthy, G, Hsu, MJ & Shieh, P. (2021). Transparent scientific reporting is imperative during the pandemic. *Pathog Glob Health*, 115(3),135-136.
- Akbari, A. (2021). Spinning-translation and the act of plagiarising: how to avoid and resist. *Journal of Further and Higher Education*, 45(1), 49-64.
- Akabayashi, A, Nakazawa, E. & Akabayashi, A. (2019). Implementation of Japan's First Clinical Research Regulatory Law: Background, Overview, and Challenges. *HEC Forum*, 31(4), 283-294.
- Alba, S et al. (2020). Bridging research integrity and global health epidemiology (BRIDGE) guidelines: explanation and elaboration. *BMJ Glob Health*, 5(10).
- Al-Ghareeb, A et al. (2018). Retraction of publications in nursing and midwifery research: A systematic review. *Int J Nurs Stud*, 81, 8-13.
- Aliukonis, V, Poškutė, M. & Gefenas, E. (2020). Perish or Publish Dilemma: Challenges to Responsible Authorship. *Medicina (Kaunas)*, 56(3).
- All European Academies (ALLEA). (2017). *The European Code of Conduct for Research Integrity, revised edition*. [Available from: <https://allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-Research-Integrity-2017.pdf>].
- Alnot, J et al. (2021). *Research Ethics and Integrity trainings for doctoral students in France: a national overview*. in ENRIO 2021 Congress on Research Integrity Practice.
- Alonso-Galbán, P and Alemañy-Castilla, C. (2020). Curbing Misinformation and Disinformation in the COVID-19 Era: A View from Cuba. *MEDICC Rev*, 22(2), 45-46.
- Angadi, PV and Kaur, H. (2020) Research Integrity at Risk: Predatory Journals Are a Growing Threat. *Arch Iran Med*, 23(2), 113-116.
- Antes, AL, Mart, A. & DuBois, JM. (2016). Are Leadership and Management Essential for Good Research? An Interview Study of Genetic Researchers. *J Empir Res Hum Res Ethics*, 11(5), 408-423.
- Armond, ACV et al. (2021). A scoping review of the literature featuring research ethics and research integrity cases. *BMC medical ethics*, 22(1),50.
- Aubert Bonn, N, Godecharle, S & Dierickx, K. (2017). European Universities' Guidance on Research Integrity and Misconduct. *Journal of Empirical Research on Human Research Ethics*, 12(1), 33-44.
- Aubert Bonn, N & Pinxten, W. (2021). Advancing science or advancing careers? Researchers' opinions on success indicators. *PLoS One*, 16(2).
- Aubert Bonn, N & Pinxten, W. (2021). Rethinking success, integrity, and culture in research (part 1) — a multi-actor qualitative study on success in science. *Research Integrity and Peer Review*, 6(1), 1.
- Aubert Bonn, N & Pinxten, W. (2021). Rethinking success, integrity, and culture in research (part 2) — a multi-actor qualitative study on problems of science. *Research Integrity and Peer Review*, 6(1), 3.
- Baker, M (2016). 1,500 scientists lift the lid on reproducibility. *Nature*, 533(7604), 452-454.
- Ball, P & Maxmen, A. (2020). The epic battle against coronavirus misinformation and conspiracy theories. *Nature*, 581(7809), 371-374.
- Barnett, AG et al. (2017). Using democracy to award research funding: an observational study. *Research Integrity and Peer Review*, 2(1), 16.

- Barr, D et al. (2020). First meeting in Asia of the Asia Pacific Research Integrity network. *Account Res*, 27(2), 99-106.
- Baur, X, Soskolne, CL & Bero, LA. (2019). How can the integrity of occupational and environmental health research be maintained in the presence of conflicting interests? *Environmental Health: A Global Access Science Source*, 18(1), 93.
- Beall, J. (2017). Research Integrity Corner: Special Issue on Predatory Journals. *Biochemia Medica*, 27(2), 273-78.
- Bello, M & Galindo-Rueda, F. (2020). Charting the digital transformation of science: Findings from the 2018 OECD International Survey of Scientific Authors (ISSA2), *OECD Science, Technology and Industry Working Papers*, 2020/03. OECD Publishing, Paris
- Bianchini, AD & Mastroleo, I. (2018). National Scientific Misconduct Policies in Argentina: Two Definitions of Research Misconduct. *Accountability in research*, 25(7-8), 419-422.
- Bishop, BW, Nobles, R. & Collier, H. (2021). Research Integrity Officers' Responsibilities and Perspectives on Data Management Plan Compliance and Evaluation. *Journal of Research Administration*, 52(1), 76-101.
- Boerckel, JD, Plotkin, LI & Sims, NA. (2021). Editorial Peer Reviewers as Shepherds, Rather Than Gatekeepers. *J Bone Miner Res*, 36(7), 1220-1224.
- Bordewijk, EM et al. (2021). An investigation of seven other publications by the first author of a retracted paper due to doubts about data integrity. *Eur J Obstet Gynecol Reprod Biol*, 261, 236-241.
- Bordewijk, EM et al. (2020). Data integrity of 35 randomised controlled trials in women' health. *Eur J Obstet Gynecol Reprod Biol*, 249, 72-83.
- Bouter, LM et al. (2016). Ranking major and minor research misbehaviors: results from a survey among participants of four World Conferences on Research Integrity. *Research Integrity and Peer Review*, 1(1), 17.
- Bouter, LM & Hendrix, S. (2017). Both Whistleblowers and the Scientists They Accuse Are Vulnerable and Deserve Protection. *Account Res*, 24(6), 359-366.
- Bozzo, A et al. (2017). Retractions in cancer research: a systematic survey. *Research Integrity and Peer Review*, 2(1), 5.
- Bradley, S. (2019). Time for a real manifesto. *BMJ Evidence-Based Medicine*, 24(Supplement 1), A1-A2.
- Bramstedt, KA. (2020). Luxembourg's approach to research integrity during the COVID-19 pandemic. *Account Res*, 27(6), 396-400.
- Bramstedt, KA & Xu, J. (2019). A 10-year follow up of publishing ethics in China: what is new and what is unchanged. *Research Integrity and Peer Review*, 4(1), 17.
- Bruton, SV et al. (2020). Personal Motivations and Systemic Incentives: Scientists on Questionable Research Practices. *Science and engineering ethics*, 26(3), 1531-1547.
- Bucceri, A, Hornung, P & Schindler, TM. (2019). Predatory publishing – what medical communicators need to know. *Medical Writing*, 28(3), 28-33.
- Buljan, I, Barać, L & Marušić, A. (2018). How researchers perceive research misconduct in biomedicine and how they would prevent it: A qualitative study in a small scientific community. *Account Res*, 25(4), 220-238.

- Buruk, B, Ekmekci, PE & Arda, B. (2021). Research and randomized clinical trials during the covid-19 pandemic: Could ethics guide us? *Medicine and Law*, 40(2), 181-198.
- Candal-Pedreira, C, Ruano-Ravina, A & Pérez-Ríos, M. (2021). Should the European Union have an office of research integrity? *European Journal of Internal Medicine*, S0953-6205 (21) 00259-4.
- Capps, B. (2016) Can a good tree bring forth evil fruit? the funding of medical research by industry. *British Medical Bulletin*, 118(1), 5-15.
- Carlisle, A et al. (2018). Financial Conflicts of Interest Among Authors of Urology Clinical Practice Guidelines. *Eur Urol*, 74(3), 348-354.
- Carter J, (2020) *Rebuilding Science and Scientific Integrity at the US Department of Agriculture*.
- Carter J, (2020) Strengthening Scientific Integrity at the Environmental Protection Agency. *JSTOR*.
- Casadevall, A et al. (2016). A framework for improving the quality of research in the biological sciences. *mBio*, 7(4), e01256-16.
- Christian, K et al. (2021). *A survey of early-career researchers in Australia*. *eLife*, 10, e60613.
- Chubb, J & Watermeyer, R. (2017). Artifice or integrity in the marketization of research impact? Investigating the moral economy of (pathways to) impact statements within research funding proposals in the UK and Australia. *Studies in Higher Education*, 42(12), 2360-2372.
- Cintas, P. (2016). Peer review: From recognition to improved practices. *FEMS Microbiology Letters*, 363(12), 1-4.
- Civitelli, R & Duffy, K. (2018). *The Rise of Research Integrity: Everyone Will Play a Role*. Wiley Online Library.
- Clynes, M, Corbett, A & Overbaugh, J. (2019). Why we need good mentoring. *Nat Rev Cancer*, 19(9), 489-493.
- Collaborative Working Group from the Keeping the Pool Clean: Prevention and Management of Misconduct Related Retractions conference. (2018). RePAIR consensus guidelines: Responsibilities of Publishers, Agencies, Institutions, and Researchers in protecting the integrity of the research record. *Research Integrity and Peer Review*, 3(15), 1-5.
- Colloff, MJ, Grafton, RQ & Williams, J. (2021) *Scientific integrity, public policy and water governance in the Murray-Darling Basin, Australia*. *Australasian Journal of Water Resources*, 25(2), 121-140.
- Cooper, AN & Dwyer, JE. (2021). Maintaining the integrity of the scientific record: corrections and best practices at The Lancet group. *European Science Editing*, 47, e62065.
- Cortegiani, A, Manca, A & Giarratano, A. (2020). Predatory journals and conferences: why fake counts. *Curr Opin Anaesthesiol*, 33(2), 192-197.
- Cortegiani, A et al, Predatory open-access publishing in critical care medicine. *J Crit Care*, 50, 247-249.
- Cyranoski, D. (2018). China introduces sweeping reforms to crack down on academic misconduct news. *Nature*, 558(7709), 171.
- Dadkhah, M, Lagzian, M. & Borchardt, G. (2018). Identity Theft in the Academic World Leads to Junk Science. *Sci Eng Ethics*, 24(1), 287-290.
- Davies, SR. (2019). An Ethics of the System: Talking to Scientists About Research Integrity. *Sci Eng Ethics*, 25(4), 1235-1253.

- de Cássia Cassimiro, M. (2017). Scientific integrity and Conflict of interest in biomedical research: the importance of collective responsibility. *Políticas de integridade científica, Bioética e Biossegurança no Seculo XXI*, 22.
- Degn, L. (2020). Integrating Integrity: The Organizational Translation of Policies on Research Integrity. *Sci Eng Ethics*, 26(6), 3167-3182.
- Dejo-Vásquez, M, Lescano, R & Pérez-Carreño, JG. (2021). The value of the world conferences on research integrity: perspectives from Peru. *Forensic Sciences Research*, 6, 1-3.
- De Peuter, S & Conix, S. (2021). Fostering a Research Integrity Culture: Actionable Advice for Institutions. *PsyArXiv*, 1-20.
- De Peuter, S & Conix, S. (2021). The modified lottery: Formalizing the intrinsic randomness of research funding. *Accountability in Research*, 29.
- De Frieze, J. (2020). Largest ever research integrity survey flounders as universities refuse to cooperate.
- Desmond, H & Dierickx, K. (2021). Research integrity codes of conduct in Europe: Understanding the divergences. *Bioethics*, 35(5), 414-428.
- Dinis-Oliveira, RJ. (2020). COVID-19 research: pandemic versus “paperdemic”, integrity, values and risks of the “speed science”. *Forensic Sciences Research*, 5(2), 174-187.
- Diong, J et al. (2021). Strengthening the incentives for responsible research practices in Australian health and medical research funding. *Research Integrity and Peer Review*, 6(1), 11.
- D’Souza, DM, Sade RM & Moffatt-Bruce, SD. (2020). The many facets of research integrity: What can we do to ensure it? *The Journal of thoracic and cardiovascular surgery*, 160(3), 730-733.
- Dufwenberg, M & Martinsson, P. (2019). Sealed envelope submissions foster research integrity. *Revue économique*, 70(6), 919-926.
- Dutra dos Reis, N et al. (2021) Frequency of receiving requested data for a systematic review and associated factors: A cross-sectional study. *Accountability in Research*, 29
- Edwards, MA & Roy, S. (2017). Academic Research in the 21st Century: Maintaining Scientific Integrity in a Climate of Perverse Incentives and Hypercompetition. *Environmental Engineering Science*, 34(1), 51-61.
- Ekmekci, PE. (2017). An increasing problem in publication ethics: Publication bias and editors’ role in avoiding it. *Med Health Care Philos*, 20(2), 171-178.
- El-Menyar, A et al. (2021). Publications and retracted articles of COVID-19 pharmacotherapy-related research: A systematic review. *Sci Prog*, 104(2)
- Else, H. (2020). How a torrent of COVID science changed research publishing – in seven charts. *Nature*, 588, 553.
- Elsevier and Sense about Science. (2019). Quality, trust & peer review: researchers’ perspectives 10 years on.
- European Science Foundation. (2018). ESF to run a new EC Project aiming at building an ethics and integrity framework for all non-medical research. [Press Release] <https://www.esf.org/news-media/news-press-releases/article/esf-to-run-a-new-ec-project-aiming-at-building-an-ethics-and-integrity-framework-for-all-non-medical/>

- Evans, N et al. (2021). Virtue-based ethics and integrity of research: train-the-trainer programme for upholding the principles and practices of the European Code of Conduct for Research Integrity (VIRT²UE). *Research Ideas and Outcomes*, 7, e68258.
- Felaefel, M et al. (2018). A Cross-Sectional Survey Study to Assess Prevalence and Attitudes Regarding Research Misconduct among Investigators in the Middle East. *Journal of Academic Ethics*, 16(1), 71-87.
- Fernandes, LB. (2017). Embedding responsible conduct in learning and research into an Australian undergraduate curriculum. *Biochem Mol Biol Educ*, 45(1), 53-59.
- Fernandez-Patron, C & Hardy, E. (2018). A New Science Publishing System for a Budding Science Publishing Crisis. *Sci Eng Ethics*, 24(2), 805-808.
- Fiala, C & Diamandis, EP. (2019). The democratization of scientific publishing. *BMC Med*, 17(1), 12.
- Fischhoff, B et al. (2021). A secure procedure for early career scientists to report apparent misconduct. *Life Sci Soc Policy*, 17(1), 2.
- Fleming, TR, Labriola, D & Wittes, J. (2020). Conducting Clinical Research During the COVID-19 Pandemic Protecting Scientific Integrity. *JAMA*, 324(1), 33-34.
- Forsberg, EM et al. (2018). Working with Research Integrity-Guidance for Research Performing Organisations: The Bonn PRINTEGER Statement. *Sci Eng Ethics*, 24(4), 1023-1034.
- Freckelton, I. (2019). Encouraging and Rewarding the Whistleblower in Research Misconduct Cases. *Journal of law and medicine*, 26(4), 719-731.
- Frias-Navarro, D et al. (2020). Spanish Scientists' Opinion about Science and Researcher Behavior. *Spanish Journal of Psychology*.
- Fuerholzer, K, Schochow M. & Steger, F. (2020). Good Scientific Practice: Developing a Curriculum for Medical Students in Germany. *Sci Eng Ethics*, 26(1), 127-139.
- Gallo, SA et al. (2020). The Participation and Motivations of Grant Peer Reviewers: A Comprehensive Survey. *Sci Eng Ethics*, 26(2), 761-782.
- Ganascia, JG. (2021). Ethics and Scientific Integrity at the Time of COVID-19. *Revue de neuropsychologie*.
- Godecharle, S et al. (2018). Scientists Still Behaving Badly? A Survey Within Industry and Universities. *Science and engineering ethics*, 24(6), 1697-1717.
- Goldberg, AC et al. (2019). Scientific integrity 2.0: misconduct. Let's prevent, not punish! *Einstein (Sao Paulo)*, 17(4), eED5064.
- Goodman, JL & Borio, L. (2020). Finding effective treatments for COVID-19: scientific integrity and public confidence in a time of crisis. *Jama*, 323(19), 1899-1900.
- Gopalakrishna, G. (2021). Preprint advocates must also fight for research integrity. *Nature*.
- Grey, A et al. (2019). Quality of reports of investigations of research integrity by academic institutions. *Research Integrity and Peer Review*, 4(1), 1-6.
- Grondin, C et al. (2021). Ethical Perspectives of Chinese and United States Physicians at Initiation of a Research Collaborative. *Accountability in Research*, 29(5), 294-308.
- Guzman-Prado, Y. (2020). Retraction of studies on potential drug therapies for COVID-19: A call for reliability and scientific integrity. *American Journal of Cardiology*, 132, 173.

- Hardie, L. (2019). *Governing for research integrity: some theoretical and practical lessons from an industry-funded unconventional gas research centre in Australia*. University of Queensland
- Haven, T et al. (2021). Explaining variance in perceived research misbehavior: results from a survey among academic researchers in Amsterdam. *Research Integrity and Peer Review*, 6(1), 7.
- Haven, T et al. (2020). Researchers' Perceptions of a Responsible Research Climate: A Multi Focus Group Study. *Sci Eng Ethics*, 26(6), 3017-3036.
- Haven, T et al. (2019). Perceptions of research integrity climate differ between academic ranks and disciplinary fields: Results from a survey among academic researchers in Amsterdam. *PLoS One*, 14(1), e0210599.
- Haven, T et al. (2019). Researchers' perceptions of research misbehaviours: a mixed methods study among academic researchers in Amsterdam. *Research Integrity and Peer Review*, 4(1), 25.
- Hayden, JA et al. (2021). Meta-epidemiological study of publication integrity, and quality of conduct and reporting of randomized trials included in a systematic review of low back pain. *Journal of Clinical Epidemiology*, 134, 65-78.
- Hebrang Grgić, I & Guskić, M. (2019). Croatian scientists' awareness of predatory journals. *International Journal for Educational Integrity*, 15(1).
- Heck, S et al. (2021). *Fake data, paper mills, and their authors: The International Journal of Cancer reacts to this threat to scientific integrity*. Wiley Online Library.
- Helgesson, G & Eriksson, S. (2018). Responsibility for scientific misconduct in collaborative papers. *Med Health Care Philos*, 21(3), 423-430.
- Helgesson, G & Eriksson, S. (2018). Revise the ICMJE Recommendations regarding authorship responsibility! *Learned Publishing*, 31(3), 267-269.
- Heuritsch, J. (2021). Reflexive behaviour: How publication pressure affects research quality in astronomy. *Publications*, 9(4).
- Hill, JA et al. (2019). Medical Misinformation: Vet the Message! *J Interv Card Electrophysiol*, 55(1), 1-3.
- Hinton, J, Reeves T & Shah, BN. (2021). Analysis of conflicts of interest among authors and researchers of European clinical guidelines in cardiovascular medicine. *Clin Med (Lond)*, 21(2), e166-e170.
- Horbach, S et al. (2020). On the Willingness to Report and the Consequences of Reporting Research Misconduct: The Role of Power Relations. *Sci Eng Ethics*, 26(3), 1595-1623.
- Hussinger, K & Pellens, M. (2019). Scientific misconduct and accountability in teams. *PLoS ONE*, 14(5), e0215962.
- Hofmann, B et al. (2020). Research Integrity Among PhD Students at the Faculty of Medicine: A Comparison of Three Scandinavian Universities. *J Empir Res Hum Res Ethics*, 15(4), 320-329.
- Hofmann, B & Holm, S. (2019). Research integrity: environment, experience, or ethos? *Research Ethics*, 15(3-4), 1-13.
- Holcombe, A. (2019). Contributorship, Not Authorship: Use CRediT to Indicate Who Did What. *Publications*, 7(3), 48.
- Hosseini, M & Lewis, J. (2020). The norms of authorship credit: Challenging the definition of authorship in The European Code of Conduct for Research Integrity. *Accountability in Research*, 27(2), 80-98.

- Hosseini, M et al. (2018). Doing the Right Thing: A Qualitative Investigation of Retractions Due to Unintentional Error. *Sci Eng Ethics*, 24(1), 189-206.
- Hsu, NS et al. (2021). Ethical considerations of COVID-19-related adjustments to clinical research. *Nature Medicine*, 27(2), 191-193.
- Huybers, T, Greene, B & Rohr, DH. (2020). Academic research integrity: Exploring researchers' perceptions of responsibilities and enablers. *Accountability in Research*, 27(3), 146-177.
- Jensen, LB et al. (2018). Research integrity among PhD students within clinical research at the University of Southern Denmark. *Dan Med J*, 65(4).
- Jesus-Silva S & Antonio, A. (2021). Research integrity in times of pandemic. *Rev Cienc Saude*, 11, 3-5.
- Johal, J et al. (2017). Beware of the predatory science journal: A potential threat to the integrity of medical research. *Clinical anatomy*, 30(6), 767-773.
- Kalichman, M, (2020). Survey study of research integrity officers' perceptions of research practices associated with instances of research misconduct. *Research Integrity and Peer Review*, 5(1), 17.
- Kamali, N, Talebi Bezmin Abadi, A. & Rahimi, F. (2020). Plagiarism, Fake Peer-Review, and Duplication: Predominant Reasons Underlying Retractions of Iran-Affiliated Scientific Papers. *Sci Eng Ethics*, 26(6), 3455-3463.
- Katsarov, J et al. (2021). Effective Strategies for Research Integrity Training—a Meta-analysis. *Educational Psychology Review*, 1-21.
- Kennedy, MR et al. (2018). *Promoting Integrity as an Integral Dimension of Excellence in Research. Investigating the workforce: experiences of research integrity and misconduct through focus groups.* [Report on focus group findings]. PRINTEGER available from https://printeger.eu/wp-content/uploads/2019/01/D4_3-Investigating-the-work-floor_experience-through-Focus-groups.pdf
- Kolstoe, S. (2017). *Ethics committees, managed through the Health Research Authority (HRA), are key for monitoring research integrity.* University of Portsmouth
- Kretser, A et al. (2019). Scientific Integrity Principles and Best Practices: Recommendations from a Scientific Integrity Consortium. *Sci Eng Ethics*, 25(2), 327-355.
- Lei, L & Zhang, Y. (2018). Lack of Improvement in Scientific Integrity: An Analysis of WoS Retractions by Chinese Researchers (1997-2016). *Sci Eng Ethics*, 24(5), 1409-1420.
- Li, D & Cornelis, G. (2020). Defining and Handling Research Misconduct: A Comparison Between Chinese and European Institutional Policies. *J Empir Res Hum Res Ethics*, 15(4), 302-319.
- Li, D & Cornelis, G. (2021). Differing perceptions concerning research misconduct between China and Flanders: A qualitative study. *Accountability in Research*, 28(2), 63-94.
- Li, D & Cornelis, G. (2018). How do researchers perceive research misbehaviors? A transcultural case study of Chinese and Flemish researchers. *Accountability in Research*, 25(6), 350-369.
- Logan, J et al. (2016). Social responsibility of the global health researcher: A research ethics video training module. *Annals of Global Health*, 82(3), 477.
- Mabou Tagne, A et al. (2020). Perceptions and Attitudes about Research Integrity and Misconduct: a Survey among Young Biomedical Researchers in Italy. *Journal of Academic Ethics*, 18(2), 193-205.
- Mahase, E. (2019). Research integrity: UK guidelines are updated to ensure misconduct reporting. *BMJ*, 2019, 367.

- Mahmoudi, M & Keashly, L. (2020). COVID-19 pandemic may fuel academic bullying. *BiolImpacts*, 10(3), 139-140.
- Malički, M et al. (2020). Preprint Servers' Policies, Submission Requirements, and Transparency in Reporting and Research Integrity Recommendations. *Jama*, 324(18), 1901-1903
- Mamelund, SE, Breit, E & Forsberg, EM. (2018). Promoting Integrity as an Integral Dimension of Excellence in Research. A multinational survey on research misconduct and integrity: a workflow perspective. PRINTEGER available from <https://printeger.eu/wp-content/uploads/2018/02/D4.2.pdf>
- Marusic, A et al. (2016). Interventions to prevent misconduct and promote integrity in research and publication. *Cochrane Database of Systematic Reviews*, 2016(4), MR000038.
- Mayo-Wilson, E et al. (2021). Evaluating implementation of the Transparency and Openness Promotion (TOP) guidelines: the TRUST process for rating journal policies, procedures, and practices. *Research Integrity and Peer Review*, 6(1), 9.
- McNutt, M, Córdova FA & Allison, DB. (2021). The Strategic Council for Research Excellence, Integrity, and Trust. *Proceedings of the National Academy of Sciences*, 118(41).
- McNutt, MK et al. (2018). Transparency in authors' contributions and responsibilities to promote integrity in scientific publication. *Proceedings of the National Academy of Sciences*, 115(11), 2557-2560.
- Mejlgaard, N et al. (2020). Research integrity: nine ways to move from talk to walk. *Nature*, 586(7829), 358-360.
- Memon, AR. (2018). Predatory Journals Spamming for Publications: What Should Researchers Do? *Sci Eng Ethics*, 24(5), 1617-1639.
- Misra, DP, Agarwal V & Ravindran V. (2018). Integrity of Authorship and Peer Review Practices: Challenges and Opportunities for Improvement. *Journal of Korean Medical Science* 33(46), e287.
- Mlinaric, A, Horvat, M & Smolicic, VS. (2017). Dealing with the positive publication bias: Why you should really publish your negative results. *Biochemia Medica*, 27(3), 030201
- Moher, D et al. (2020). The Hong Kong Principles for assessing researchers: Fostering research integrity. *PLoS Biol*, 18(7), e3000737.
- Morens, D & Hammatt, Z. (2021). The COVID-19 pandemic: some thoughts on integrity in research and communication. *Forensic Sciences Research*, 1-6.
- National Academies of Sciences, Engineering, and Medicine. (2019). *Reproducibility and replicability in science*. The National Academies Press: Washington DC.
- Nishimura, R et al. (2021). Experience and awareness of research integrity among Japanese physicians: a nationwide cross-sectional study. *BMJ Open*, 11(10), e052351.
- Nouchi, R et al. (2020). Toward global standardization of conducting fair investigations of allegations of research misconduct. *Accountability in Research*, 27(6), 327-346.
- OECD. (2021). Science in the face of the COVID-19 crisis: OECD Science Flash Survey 2020. [cited 29.11.2021]; Available from: <https://oecdsciencesurveys.github.io/2020flashsciencecovid/>.
- Okoduwa, SIR et al. (2018). Attitudes, Perceptions, and Barriers to Research and Publishing Among Research and Teaching Staff in a Nigerian Research Institute. *Frontiers in Research Metrics and Analytics*, 3(26).

- Olesen, A, Mahadi, Z & Amin, L. (2018). In Their Own Words: Research Misconduct from the Perspective of Researchers in Malaysian Universities. *Sci Eng Ethics*, 24(6), 1755-1776.
- Page, SA & Stalker, MA. (2019). Canadian policy on reporting breaches of research integrity: When should Research Ethics Boards be informed? *Accountability in Research*, 26(7), 460-471.
- Pan, SJ & Chou, C. (2020). Taiwanese Researchers' Perceptions of Questionable Authorship Practices: An Exploratory Study. *Sci Eng Ethics*, 26(3), 1499-1530.
- Patel, J. (2018). New COPE guidelines on publication process manipulation: why they matter. *Research Integrity and Peer Review*, 3(1), 13.
- Patel, J et al. (2017). Do peer review models affect clinicians' trust in journals? A survey of junior doctors. *Research Integrity and Peer Review*, 2(1), 11.
- Phillips, T et al. (2019). Assessing Trustworthiness in Research: A Pilot Study on CV Verification. *Journal of Empirical Research on Human Research Ethics*, 14(4), 353-364.
- Phillips, T et al. (2018). America COMPETES at 5 years: An Analysis of Research-Intensive Universities' RCR Training Plans. *Sci Eng Ethics*, 24(1), 227-249.
- Pillay, DG & Qhobela, M. (2019). Research ethics and integrity challenges require innovative approaches. *South African Journal of Science*, 115(11-12), 1-3.
- Pizzolato, D & Dierickx, K. (2021). Stakeholders' perspectives on research integrity training practices: a qualitative study. *BMC Med Ethics*, 22(1), 67.
- Pond, BB et al. (2019). Faculty Applicants' Attempt to Inflate CVs Using Predatory Journals. *Am J Pharm Educ*, 83(1), 7210.
- Rajkumar, SV & Sampathkumar, P. (2020). Leaks of clinical trial data and research integrity. in Mayo Clinic Proceedings. *Mayo Clin Proc*, 95(7), 1318-1319.
- Redman, B. (2019). Correctable Myths About Research Misconduct in the Biomedical Sciences. *Sci Eng Ethics*, 25(2), 621-629.
- Reichlin, TS, Vogt, L & Würbel, H. (2016). The Researchers' View of Scientific Rigor-Survey on the Conduct and Reporting of In Vivo Research. *PLoS One*, 11(12), e0165999.
- Reisig, MD, Holtfreter, K & Berzofsky, ME. (2020). Assessing the perceived prevalence of research fraud among faculty at research-intensive universities in the USA. *Accountability in Research*, 27(7), 457-475.
- Research integrity: time for global action. (2019). *The Lancet*
- Richtig, G et al. (2018). Problems and challenges of predatory journals. *J Eur Acad Dermatol Venereol*, 32(9), 1441-1449.
- Rifai, N et al. (2019). Maintaining research and publication integrity. *Clinical Chemistry*, 65(2), 230-235.
- Rohwer, A et al. (2017). Authorship, plagiarism and conflict of interest: views and practices from low/middle-income country health researchers. *BMJ Open*, 7(11), e018467.
- Rohwer, A, Young, T & Wager, E. (2019). Advancing research integrity: A programme to embed good practice in Africa. *Pan African Medical Journal*, 33, 298.
- Roje, R et al. (2021). Development and implementation of research integrity guidance documents: explorative interviews with research integrity experts. *Accountability in Research*, Oct 13, 1-38.

- Satalkar, P & Shaw, D. (2019). How do researchers acquire and develop notions of research integrity? A qualitative study among biomedical researchers in Switzerland. *BMC Med Ethics*, 20(1), 72.
- Scepanovic, R et al. (2021). Practices for Research Integrity Promotion in Research Performing Organisations and Research Funding Organisations: A Scoping Review. *Sci Eng Ethics*, 27(1), 4.
- Schocker, F, Fehrenbach, H & Schromm, AB. (2021). Mission impossible?: A cultural change to support scientific integrity. *EMBO Rep*, 22(7), e52334.
- Shahare, M & Roberts, LL. (2020). Historicizing the crisis of scientific misconduct in Indian science. *History of science*, 58(4), 485-506.
- Sharma, H & Verma, S. (2020). Insight into modern-day plagiarism: The science of pseudo research. *Tzu Chi Medical Journal*, 32(3), 240-244.
- Smilowitz, NR, Ferguson, JJ & Weisz, G. (2018). Controversies surrounding authorship of manuscripts by industry employees: academic and industry perspectives. *EuroIntervention*, 13(16), 1967-1974.
- Smith, E et al. (2020). Misconduct and Misbehavior Related to Authorship Disagreements in Collaborative Science. *Sci Eng Ethics*, 26(4), 1967-1993.
- Stavale, R et al. (2019). Research misconduct in health and life sciences research: A systematic review of retracted literature from Brazilian institutions. *PLoS ONE*, 14(4), e0214272.
- Stewardson, MJ et al. (2021). The politicisation of science in the Murray-Darling Basin, Australia: discussion of 'Scientific integrity, public policy and water governance'. *Australasian Journal of Water Resources*, 25(2), 141-158.
- Strech, D, Weissgerber, T & Dirnagl, U. (2020). Improving the trustworthiness, usefulness, and ethics of biomedical research through an innovative and comprehensive institutional initiative. *PLoS Biol*, 18(2), e3000576.
- Tang, L. (2019). Five ways China must cultivate research integrity. *Nature*, 575(7784), 589-591.
- Thorp, H. (2020). Reproducibility, Scientific Integrity, and Public Engagement in the Age of Digital Misinformation and COVID-19 in *AGU Fall Meeting Abstracts*.
- Tjeldink, JK et al. Towards a Research Agenda for Promoting Responsible Research Practices. *Journal of Empirical Research on Human Research Ethics*, 16(4), 450-460.
- Trumping science. (2020) *Nat Biotechnol*, 38, 1105.
- UK Research and Innovation. (2021). *Research integrity*. Available from: <https://www.ukri.org/our-work/supporting-healthy-research-and-innovation-culture/research-integrity/>.
- Universities UK. (2022). *The concordat to support research integrity*. Available from: <https://www.universitiesuk.ac.uk/topics/research-and-innovation/concordat-support-research-integrity>
- Van Nuland, SE & Rogers, KA. (2017). Academic nightmares: Predatory publishing. *Anat Sci Educ*, 10(4), 392-394.
- Wager, E. (2019). UK universities compliance with the Concordat to Support Research Integrity: Findings from cross-sectional time-series. *PeerJ*, 2019(7), 7292.
- Wager, E et al. (2021). Cooperation & Liaison between Universities & Editors (CLUE): recommendations on best practice. *Research Integrity and Peer Review*, 6(1), 6.
- Wager, E & Kleinert, S. (2021). Giving editors and institutions some CLUEs about research integrity cases. *European Science Editing*, 47

- Wang, F & Li, Y. (2020). How Chinese scientific societies should promote the construction of research integrity. *Accountability in Research*, 27(5), 271-283.
- When it comes to good practice in science, we need to think global but act local. (2019). *Nature*, 576, 181.
- Williams, L. (2019). If you can't beat 'em, join 'em: Combating poor scientific practice with a quantitative, openaccess research metric. *BMJ Evidence-Based Medicine*, 24(Supplement 1), A1.
- Winker, M. (2021). What Can COVID Teach Us about Research Integrity? *The National Medical Journal of India*, 34(2), 65-65.
- Woolston, C. (2020). Pandemic darkens postdocs' work and career hopes. *Nature*, 585(7824), 309-312.
- Wright, DE, Titus SL & Cornelison, JB. (2018). Mentoring and research misconduct: Analysis of research mentoring in closed ORI cases, in *Getting to Good: Research Integrity in the Biomedical Sciences*, 234-248.
- Yeo-Teh, NSL & Tang, BL. (2021). A research misconduct severity matrix that could serve to harmonize adjudication of findings. *Accountability in Research*, 29(5), 279-293
- Yi, N, Nemery B. & Dierickx, K. (2019). How do Chinese universities address research integrity and misconduct? A review of university documents. *Dev World Bioeth*, 19(2), 64-75.
- Yi, N, Nemery B. & Dierickx, K. (2019). Perceptions of research integrity and the Chinese situation: In-depth interviews with Chinese biomedical researchers in Europe. *Accountability in Research*, 26(7), 405-426.
- Yu, L et al. (2021). Scientific misconduct and associated factors: A survey of researchers in three Chinese tertiary hospitals. *Accountability in Research*, 28(2), 95-114.
- Yu, L et al. (2020). A study of researchers' recognition of research integrity and scientific misconduct in the workplace in Tertiary Hospital. *Chinese Journal of Medical Science Research Management*, 299-304.
- Zwart, H & Ter Meulen, R. (2019). Addressing research integrity challenges: from penalising individual perpetrators to fostering research ecosystem quality care. *Life Sci Soc Policy*, 15(1), 5.

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LONDON

The Adelphi
1-11 John Adam Street
London WC2N 6HT
United Kingdom
Tel: (44) 20 7830 7000
Email: london@eiu.com

GENEVA

Rue de l'Athénée 32
1206 Geneva
Switzerland
Tel: (41) 22 566 2470
Fax: (41) 22 346 93 47
Email: geneva@economist.com

SÃO PAULO

Rua Joaquim Floriano,
1052, Conjunto 81
Itaim Bibi, São Paulo,
SP, 04534-004
Brasil
Tel: +5511 3073-1186
Email: americas@economist.com

NEW YORK

750 Third Avenue
5th Floor
New York, NY 10017
United States
Tel: (1.212) 554 0600
Fax: (1.212) 586 1181/2
Email: americas@economist.com

DUBAI

Office 1301a
Aurora Tower
Dubai Media City
Dubai
Tel: (971) 4 433 4202
Fax: (971) 4 438 0224
Email: dubai@economist.com

WASHINGTON DC

1920 L street NW Suite 500
Washington DC 20002
United States
Email: americas@economist.com

HONG KONG

1301
12 Taikoo Wan Road
Taikoo Shing
Hong Kong
Tel: (852) 2585 3888
Fax: (852) 2802 7638
Email: asia@economist.com

SINGAPORE

8 Cross Street
#23-01 Manulife Tower
Singapore
048424
Tel: (65) 6534 5177
Fax: (65) 6534 5077
Email: asia@economist.com