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Research integrity:
a landscape study

June 2020

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Research integrity: a landscape study

Vitae in partnership with the UK Research Integrity Office (UKRIO) and the UK Reproducibility Network (UKRN)

Commissioned by UK Research and Innovation (UKRI)

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The interpretations and opinions in this report are those of the authors and may not reflect the policy positions of UKRI.

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Supporting annexes are available as separate documents.

www.ukri.org/about-us/policies-and-standards/research-integrity/

Sir Mark Walport
Chief Executive,
UK Research and Innovation

Foreword

Research integrity means undertaking and conducting research in a way that ensures it is trustworthy and ethical. It also encompasses a set of professional standards that researchers should adopt and that research organisations should promote and support to ensure this. Research integrity is central to our vision at UK Research and Innovation and cuts across all we do as a research organisation, funder and partner. As a signatory of the UUK Concordat to Support Research Integrity, we are committed to upholding the core values of honesty, rigour, transparency, care and respect, and accountability.

In January 2017, the Science and Technology Select Committee (Commons) launched an inquiry into research integrity. Following collection of both written and oral evidence, the Committee published its final report in July 2018. The Committee's report highlighted that there is a need to better understand what incentives and effects there are in the UK research and funding system that influence researcher and institutional behaviour in the context of research integrity. The report asked that UKRI commission research to understand the effects of these incentives.

Vitae, working with UK Research Integrity Office (UKRIO) and the UK Reproducibility Network (UKRN), were commissioned by UKRI to conduct a study into the effects of incentives in the research system on researcher behaviour. The study, overseen by an expert advisory group, was conducted through an extensive literature review, a survey, researcher workshops and interviews, collectively reaching over 1500 researchers and representatives of stakeholder organisations. This report synthesises the findings of these activities.

The study has found that the relationship between research incentives and research integrity is a complex one. The interconnectedness of the research ecosystem – from an individual and local cultural level through to national and international policies – creates incentives and effects (both positive and negative) that have the potential to influence behaviour in the context of research integrity.

It is assuring to hear that, of those surveyed, all researchers reported that they are motivated towards high levels of research integrity. The importance of local culture to drive forward positive incentives for research integrity is crucial. Good leadership and management, professional development, sharing research, and the opportunity to collaborate and work with colleagues from other disciplines are all considered to have strong positive impact on research integrity. At UKRI, we have already adopted practices that lead to high standards of research integrity. For example, one of our aims is to make sure that the findings of research we support can be freely accessed and widely reused in ways that can provide opportunities for economic, social, and cultural impact. Certainly, open research and open data sharing have proven to be crucial in accelerating scientific progress and sharing knowledge. Our commitment to open research will be strengthened as we continue to work and listen to our stakeholders in the development of the new UKRI Open Access policy.

The importance of interdisciplinary working, and intersectoral and international collaborations and the positive impact on research integrity should not be overlooked. Almost 8 in 10 researchers agree that undertaking interdisciplinary research drives them to achieve high levels of research integrity: opportunities to collaborate across different research contexts, and the exposure to other disciplinary norms is believed to have a positive influence. UKRI's unique position – that is, one that encourages and facilitates its nine constituent bodies to work together – means that we can build upon the strength, breadth, and diversity of UK research and encourage this approach to interdisciplinary working.

Vitae's study has found that there is a tension between researchers' strong sense of personal values to uphold research integrity and systemic pressures that risk undermining these values. Poorly designed and inappropriate research metrics and the use of university league tables have the potential to create a strong negative impact on research integrity. High workloads and precarious working conditions all contribute to perverse incentives that risk compromising research integrity.

An important and concerning finding is that incidents of bullying and harassment are cited as the top factor negatively impacting research integrity. UKRI is working with other funders and partners through a new funders' forum to join up our approaches to tackling these issues. Last year we published our bullying and harassment position statement which set out our intention to focus on strategies for prevention and improving reporting and resolution of incidents. We will continue to support research organisations to meet our expectations by improving evidence and resources on what works, recognising the role of local environments as well as national policies. More needs to be done to build trustworthiness into the research system at every step in the research lifecycle, with the aim of fostering a culture of continuous improvement, rather than blame. Over 80% of researchers agree that their immediate research environment drives them to achieve high levels of research integrity, highlighting the importance of local culture, management, and support from peers.

We know there is more than can be done to support research integrity and we are committed to catalysing the changes that are needed. The Research integrity Committee, a new arms-length body with a remit to adopt a leadership role in this area, will commence work later in the year. This report will no doubt provide a starting point for their work.

This research integrity study was conducted before the Covid-19 crisis. Yet, the importance of research to the management of this crisis emphasises that the need to uphold strong standards of research integrity is of overwhelming importance. There is a significant opportunity for all involved in the UK research system, from funders to publishers, and research organisations to learned societies, to ensure that positive incentives for maintaining this integrity are upheld, and that systemic pressures and perverse incentives are addressed.

Mark Walport

Sir Mark Walport
Chief Executive, UK Research and Innovation

The study set out to understand:

- *the 'incentives' and 'pressures' in the UK research system*
- *their perceived impact on research integrity and on researcher behaviour more broadly*
- *the extent to which the incentives are perceived as positive or negative*
- *how these perceptions differ across stakeholder groups.*

Executive summary

This report presents the findings of a study of the research integrity landscape, carried out by Vitae in partnership with UKRIO and UKRN. The study was commissioned by UKRI in response to a recommendation from the House of Commons Science and Technology Select Committee.[1]

Research integrity is defined as undertaking and conducting research in a way that ensures it is trustworthy and ethical, including the professional standards that researchers should adopt and research organisations should promote, as well as the core values of honesty, rigour, openness, transparency, care, respect and accountability (see the Concordat to Support Research Integrity, 2019).

The study was conducted through a literature review, a survey and workshops that collectively reached over 1,500 researchers and other individuals in the UK research system, and interviews with 20 representatives of stakeholder organisations. The scope was limited to the UK research system, while recognising that this sits within the broader global research environment. A range of potential incentives were explored at different levels of the research system, from the individual level, through to local, discipline, institutional, national and global levels. It is important to note, however, that this is a simplified description of the system and that many incentives operate at multiple levels and interact in complex ways.

RESEARCHERS ARE HIGHLY MOTIVATED TO BEHAVE WITH INTEGRITY

"I think the main thing to tackle would be the incentive structure, in terms of publishing, funding, promotion, etc. But ultimately the responsibility lies with the people conducting the research."

Research fellow, university (survey respondent)

A consistent message is that researchers are intrinsically motivated to achieve high levels of research integrity. 81% of the survey respondents strongly agreed that their personal integrity drives their research integrity, with another 18% agreeing. 73% reported that researchers uphold high levels of research integrity all or most of the time.

This message was underpinned by strong awareness and understanding of what research integrity encompasses, with 94% of researchers reporting that they understood the levels of research integrity expected of them. Overall, however, awareness and understanding of specific initiatives on research integrity that are in place internationally and at UK level was reported to be quite low, with the highest levels of awareness for related institutional activities such as ethical approval processes.

78%
researchers believe others feel tempted to compromise research integrity, at least some of the time

99%
agree that personal integrity drives research integrity

94%
understand the levels of research integrity expected

RESEARCHERS STRONGLY PERCEIVE TEMPTATIONS TO COMPROMISE ON RESEARCH INTEGRITY

The study revealed strongly perceived tensions that have the potential to undermine research integrity. 59% of researchers believe that other researchers feel tempted or under pressure to compromise on research integrity some of the time. A further 19% believe this temptation is felt by others most or all the time. Only 6% of respondents believe that other researchers never feel tempted. On the other hand, 59% of researchers reported that they had never personally felt tempted to compromise on research integrity.

"The vast majority of researchers have a struggling sense of personal and professional ethics, but this is constantly undermined by disciplinary, institutional and government drivers towards fulfilling goals and targets, even those ostensibly intended to promote ethics."

Director/head of department, university (survey respondent)

RELATIONSHIPS BETWEEN INCENTIVES AND RESEARCH INTEGRITY ARE DEEPLY COMPLEX

Many potential incentives across the research ecosystem were explored to understand their perceived relationships with research integrity. 'Incentives' are defined here as factors that encourage or motivate behaviour. What emerged above all was the complexity of how incentives potentially impact on research integrity. The study explored over 80 different potential incentives embedded at different levels of the research system; the individual researcher level, local research culture, disciplinary or institutional, or at play nationally and internationally.

The findings illustrate varied and nuanced perspectives, with a rich tapestry of caveats and contextualisation needed to make sense of how different groups perceive the various incentives, where they impact on the research system and whether they have an overall positive or negative influence on research integrity.

TOP FIVE INCENTIVES FOR EACH CATEGORY AS RATED FOR THEIR POTENTIAL IMPACT ON RESEARCH INTEGRITY*

Strongly positive perceived impact:	Positive and negative perceived impact:	Strongly negative perceived impact:
Data sharing policies and requirements	Media coverage and public perception of research	Incidents of bullying and harassment
Open access publishing	Research leadership and management	Use of journal impact factor (JIF), h-index and other metrics
Interdisciplinary research	How funding for specific projects is awarded	League tables of institutions
Professional development and training opportunities	How researchers are assessed for promotion during their careers	Institutional workload models
Research leadership and management	Institutional research strategy	How researchers are assessed for promotion during their careers

*Incentives phrased as asked in the survey. To some extent negatively perceived incentives can be caveated with 'poor' or 'inappropriate' (e.g. 'poor workload models' or 'inappropriate use of league tables') but not entirely.

1. House of Commons Science and Technology Committee (2019): Research Integrity: Sixth Report of Session 2017-19

The table identifies the incentives perceived as having the most strongly positive impact and the most strongly negative impact on research integrity, as well as those potentially having both positive and negative impacts. This provides a useful starting-point for considering how to improve incentive structures so that they encourage high levels of research integrity. The challenge for stakeholders, both individually and collectively, is in developing policies that emphasise and incentivise higher levels of research integrity, while avoiding (unintended) consequences for and negative pressures on it.

82%

agree their immediate research environment drives them to achieve high levels of research integrity

LOCAL CULTURE CAN STRONGLY INFLUENCE BEHAVIOUR, OVERRIDING INSTITUTIONAL AND NATIONAL POLICY

The study confirmed that the people and culture within a local research environment are perceived to have strong and persistent influences on research integrity. To some extent, local cultures are shaped by institutional practices or guidelines, but management styles and personalities of research leaders, the immediate research environment, role models and collaborators were perceived to be much stronger drivers for individuals than institutional strategy and policies. Workshop participants described this influence of the local culture in terms of "strong bonds" apparent at research group, departmental or discipline level that can be resistant to more distant "weak forces" such as institutional, national and international policies.

However, many of the key policies that influence researcher behaviour are focused at an institutional level; they include ethical approval processes, codes of practice and training and development opportunities, which all have an important role to play. Other features of the institutional environment, including employment contracts, the precarious nature of employment and institutional strategies – particularly in relation to institutional responses to the Research Excellence Framework (REF) – were all seen to potentially have both positive and negative impacts on research integrity. The competitive pressure on institutions, and more importantly how institutions respond to this pressure, was also believed to have a significant influence on the local research culture, for example in driving hiring and promotion practices and managing workloads and performance targets.

EXPOSURE TO INTERDISCIPLINARY, INTERSECTORAL AND INTERNATIONAL RESEARCH EXPERIENCES CAN BE POSITIVE FOR RESEARCH INTEGRITY

The positive potential influence of 'exposure to other norms' also emerged as a consistent theme. Opportunities to collaborate across, or move between, different research contexts were believed to have a positive influence on research integrity. Interdisciplinary working and inter-sectoral and international collaborations came through strongly as positive incentives for research integrity, potentially by increasing openness, honesty and rigour, despite the perceived challenges in funding and publishing interdisciplinary work.

50% (female)

58% (male)

respondents feel able to raise concerns without personal consequences

Additionally, the influence of disciplinary norms was generally perceived to be positive, along with perceptions of the influence of learned societies and professional bodies. There were concerns, however, about the risks to research integrity from disciplinary siloes, cliques and maintenance of the status quo, further reinforcing the benefits of working across disciplines.

SYSTEMIC PRESSURES AND PERVERSE INCENTIVES ARE DEEPLY EMBEDDED THROUGHOUT THE RESEARCH ECOSYSTEM

"It's difficult to prioritise research integrity in a sea of perverse incentives and insecure employment. There is not a personal deficit on the part of researchers in our understanding of research integrity. But we are working in a system where research integrity is not rewarded."

Research fellow, university (survey respondent)

The findings confirm a complex and pressured research ecosystem that at times appears to work against researchers' intrinsic motivations to practise high levels of research integrity, and no one aspect emerged as a single point of failure for research integrity. It is apparent that pressures are embedded throughout the research ecosystem that are widely perceived to be perverse incentives, with the potential to encourage, tempt or reward poor research integrity. The insidious nature of the 'pressure to publish' and the associated use of (inappropriate) metrics permeates all levels of the research system.

There is no direct evidence that these perverse incentives are in fact driving poor research behaviour. However, the balance of incentives operating against research integrity is perceived to be greater and stronger than those operating in favour of achieving high levels of research integrity.

The intersection between pressures on research integrity and perceptions of high levels of insecurity, a highly competitive environment and individualistic (as opposed to team-based) rewards and career structures was apparent through the generally more negative responses and discussion from those earlier in their research careers. The survey also explored differences in responses by gender and other protected characteristics, and although the sample sizes were not always large enough to compare responses, there were some differences by gender. For example, female respondents reported being less likely to feel comfortable in raising concerns about poor levels of research integrity without fear of personal consequences. Females were also less likely to know how to report instances of research misconduct, although levels of understanding of research integrity were comparable.

90%
respondents believe research integrity is compromised at least some of the time

BOOSTING RESEARCH INTEGRITY REQUIRES A CULTURE OF CONTINUOUS IMPROVEMENT

A strong message emerging from this study is the high level of personal integrity that researchers expect from themselves and others, and the extent to which the research system relies on this. Generally, individual researchers believe they can maintain high levels of research integrity, despite perceiving a range of pressures working counter to this (such as large workloads, pressure to publish and insecure employment). However, they are less confident that other researchers do not feel tempted to compromise. For a system essentially built on trust that individuals will inherently 'do the right thing', a loss of trust in each other could have serious implications for research integrity.

But considerably more could be done to build more trustworthiness into the research system at every step in the research lifecycle, with the aim of fostering a culture of continuous improvement rather than of blame. A prevailing belief pinpointed by the study is that a system that values and rewards research integrity, rather than focusing on compliance, monitoring and sanctions, will have a more positive overall effect on levels of research integrity.

NO-ONE CAN RADICALLY CHANGE THIS COMPLEX SYSTEM ALONE, BUT ALL CAN CONTRIBUTE TO IMPROVING RESEARCH INTEGRITY

There is a significant opportunity for all stakeholders to contribute to and collaborate in improving research integrity within the UK research ecosystem. Individual researchers feel strongly responsible for achieving high levels of research integrity, but there is a clear need for more support and to provide more positive incentives. Suggestions for such support included professional development and training across a range of topics, including leadership and management, integrity and ethics, research methods and statistics, and data management.

However, the findings also demonstrate that support at the individual researcher level is unlikely to be enough to embed a culture of research integrity. All stakeholders involved in this study, including researchers, managers of researchers, research integrity professionals, institutions, funders, publishers, learned societies and professional bodies, other sector bodies and governmental policy makers, identified actions they and others could take to improve research integrity drivers and acknowledged that this is a long-term agenda. Overall, the study points to a need for a sustained, multi-stakeholder effort to ensure the UK has a world-leading research ecosystem underpinned by the highest levels of research integrity.

The landscape study set out to develop a clear understanding of:

- *the 'incentives' and 'pressures' in the research system*
- *how these affect research behaviour in the context of research integrity, as well as more broadly*
- *the extent to which the incentives are considered positive or negative*
- *how these perceptions differ across stakeholder groups within the UK research system.*

1. Introduction

1.1 PURPOSE OF THE STUDY

UKRI commissioned Vitae, working in partnership with UKRIO and UKRN, to undertake a landscape study on research integrity in response to a recommendation from the House of Commons Science and Technology Select Committee in their June 2018 report on research integrity.[2] One area of particular focus within the House of Commons inquiry was the relationship between 'research culture' and 'research integrity'. The committee received evidence arguing that a positive research culture is crucial to supporting a system that embeds research integrity. In addition, some of the evidence received pointed to particular elements of the UK's current research culture that may disincentivise research integrity (such as the competitive nature of research and research funding, high competition for jobs and an assumed 'publish or perish' culture). As a result, the committee reported that there is a need to better understand what incentives and effects in the UK research and funding system influence institutional and individual behaviour in the context of research integrity.

The study's outcomes are intended to enable UKRI to assess where adjustments or counterbalances may be required within the research system to better support research integrity and to foster a positive research culture more broadly.

1.2 DEFINING RESEARCH INTEGRITY

Research integrity means undertaking and conducting research in a way that ensures it is trustworthy and ethical. It also encompasses a set of professional standards that researchers should adopt and that research organisations should promote and support to ensure this. Throughout the study, we employed the definition of research integrity that appears in the Concordat to Support Research Integrity 2019 (shown in the box), with a focus on the core values of research integrity as well as the behaviours that align to these values.

As described more fully in the literature review accompanying this report (Annex A), discussions on research integrity often overemphasise deliberate misconduct by individual researchers, even though outright fraud and data fabrication have been shown to be rare in academic research. Taking this broad definition of research integrity therefore acknowledges that, even if fraud and misconduct ceased entirely, there would still be research integrity issues due, for example, to 'questionable research practices', poor understanding of statistics and selective reporting; all of this contributes to false or non-replicable findings and are behaviours considered in this study.

2. Research integrity, House of Commons Science and Technology Committee

BOX 1

DEFINING RESEARCH INTEGRITY: FROM THE CONCORDAT TO SUPPORT RESEARCH INTEGRITY (OCTOBER 2019)[3]

Honesty in all aspects of research, including in the presentation of research goals, intentions and findings; in reporting on research methods and procedures; in gathering data; in using and acknowledging the work of other researchers; and in conveying valid interpretations and making justifiable claims based on research findings.

Rigour, in line with prevailing disciplinary norms and standards: in performing research and using appropriate methods; in adhering to an agreed protocol where appropriate; in drawing interpretations and conclusions from the research; and in communicating the results.

Transparency and open communication in declaring potential competing interests; in the reporting of research data collection methods; in the analysis and interpretation of data; in making research findings widely available, which includes publishing or otherwise sharing negative or null results to recognise their value as part of the research process; and in presenting the work to other researchers and to the public.

Care and respect for all participants in, and subjects, users and beneficiaries of research, including humans, animals, the environment and cultural objects. Those engaged with research must also show care and respect for the integrity of the research record.

Accountability of funders, employers and researchers to collectively create a research environment where individuals and organisations are empowered and enabled to own the research process. Those engaged with research must also ensure that individuals and organisations are held to account when behaviour falls short of the standards set by this concordat.

1.3 DEFINING INCENTIVES

'Incentives' are defined here as factors that encourage or motivate behaviour. They can be both extrinsic and intrinsic (externally and internally driven) and can operate either consciously or unconsciously. In addition, we assume that incentive structures can either incentivise good or bad behaviour, or disincentivise good or bad behaviour. A list of potential incentives was developed at the start of the study (building on an initial list that UKRI provided) as a rough description of the landscape; some examples are shown in Figure 1.1. The list of incentives was further refined and added to throughout the study, with over 80 potential incentives eventually explored. The **complete list of incentives** can be viewed on the Vitae website.

3. The Concordat to Support Research Integrity, 2019

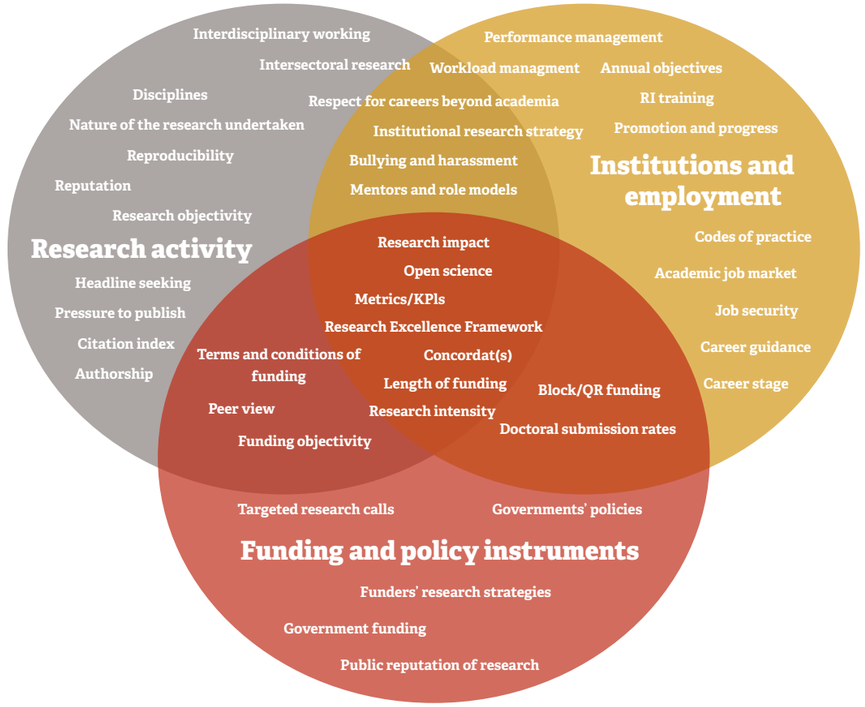


Figure 1.1
Examples of potential incentives in the research ecosystem

1.4 THE STUDY'S SCOPE AND METHODOLOGY

The focus of the study was on the UK research system. We have used the term 'research ecosystem' throughout to reflect the connected and dynamic factors at play within the research environment. The study also recognises that the UK research system sits within the broader global research environment and that some initiatives and incentives are cross-cutting.

The study used a mixed-methods and iterative approach, gathering and synthesising evidence from a combination of sources, with the emerging evidence used to inform further exploration and data collection at each phase. This report summarises the overall outcomes of this approach, with a detailed description of each data-gathering activity contained in the annexes. A summary of the main activities informing this report is set out in Table 1.1.

The core project team carried out the study in collaboration with experts in the field of research integrity. This included regular interaction with Research England and guidance from an external advisory group at key stages of the project.

Activity	Description
Literature review	Primary focus on research, reports and initiatives across the UK research system. **Annex A**
Online survey	1,084 complete responses from individuals and organisations in the UK research system (993 from researchers). Research-active respondents were grouped into postgraduate researchers, research staff and academic staff for analysis. Responses were also analysed by gender, REF Panel and disability. **Annex B**.
Workshops	Four workshops gathered views from 81 participants in total. Participants were primarily researchers selected to cover a range of career stages, disciplines and institution types (including research institutes). Other participants included research managers, research developers and senior managers. **Annex C**.
Interviews	By telephone with 20 senior representatives of stakeholder organisations, including government, funders, publishers, professional bodies and other sector bodies. **Annex D** (which includes a full list of relevant organisations).

Table 1.1
Overview of data-gathering activities informing this report

1.5 LIMITATIONS

1.5.1 The study's scope

The scope of the study extended to reviewing the extant literature, gathering further evidence through workshops, interviews and a survey, and proposing conclusions based on this synthesised evidence. While recognising that the UK research system sits within a global context, the study did not collect data on research systems outside the UK beyond the wider policy context explored to some extent through the literature review and through the personal views of researchers and wider stakeholders in the UK. Nor does its scope extend to the evaluation of incentives and their effects on the behaviour of non-researchers in the UK research system, or the effects on the behaviour of researchers outside the UK. The purpose of the study was to present the UK landscape for research integrity and to identify gaps in knowledge. It did not extend to making recommendations for action.

1.5.2 Robustness of outcomes

The primary data consisted of the views and perceptions of individuals representing different stakeholder groups, collected through a survey, workshops and interviews. All these methods mainly rely on self-reporting by individuals (including where they were representing their organisations). Each of the methods has its limitations, which are detailed in the respective annexes. To some extent this mixed-methods approach offsets the limitations of each method, but it is important to note that the limitation of self-reporting persists. Apart from the interviews, all the participants in the study self-selected to attend a workshop or to complete the survey and no incentives were provided to participants or respondents. Those motivated to give their time may therefore have come to the study with a particular view on, or strong feelings about, research integrity. The study may also be affected, for example, by biases present in the perceptions of individuals about their own or others' behaviour (e.g., exaggeration or social desirability bias).

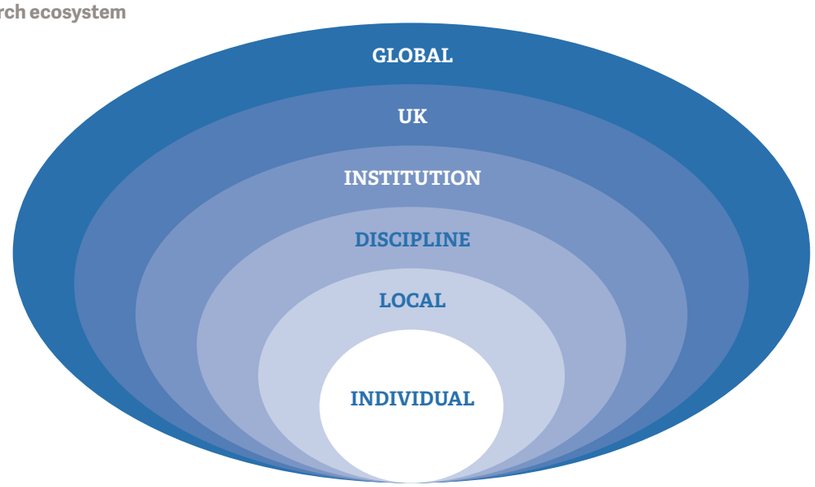
There are also limitations in the representativeness of the sample. While the survey, workshops and interviews did attract participants and respondents across all research career stages, disciplines and organisation types, the overall sample was small in comparison with the academic population. Due the size of the sample, it was not possible to analyse the data by every potential variable, such as type of research institution or some demographic characteristics (particularly ethnicity), or to undertake any intersectionality analysis. Where there are notable differences in the survey results by specific demographics, these are identified in Annex B. However, there may be more subtle relationships between the different demographic characteristics and employment contexts of survey respondents than is reported.

Overall, the final results may be biased towards the perceptions of more heavily represented groups. This is particularly true for type of research setting, due to the significantly larger number of respondents from universities than from research institutes or other public research settings, such as clinical research. It is likely that the findings are relevant to other research settings and may also partly generalise to research systems beyond the UK, but some incentive structures are specific to universities, such as the value placed on teaching compared with research, or the REF.

1.6 THE REPORT'S STRUCTURE

In this study, we aimed to understand researchers' and other stakeholders' perceptions of the impact of a range of incentives on research integrity. In the body of the report, we present our headline findings as an overview, synthesising the different evidence sources (literature review, survey, workshops and interviews) into a narrative account, using concrete examples and evidence to support the conclusions drawn. The detailed description of all the evidence gathered is presented in the annexes.

Figure 1.2
Simplified depiction of the 'layers' in the UK research ecosystem



Throughout the study we have conceived the research ecosystem as having defined 'layers', with individual researchers in the centre and the various layers of incentives, pressures, initiatives and policies operating near to or further away from the individual (see Figure 1.2). This structure is loosely reflected throughout this report and in the annexes. However, it is important to note that, in practice, this is a simplification of a complex system and these layers do not operate independently. Rather, the different incentives and pressures cut across multiple layers of the research ecosystem and interact with one another, and the evidence presented in this report further illustrates this extremely complex, interconnected and dynamic environment. In addition, where an incentive is placed in the structure of the report does not necessarily indicate where it originates within the wider policy environment.

The literature review (Annex A) considered a range of cross-cutting factors that may modify the impact of incentives on behaviour, including career stage, contract type and protected characteristics. At each level in the research ecosystem, we asked the following questions:

1. *what drives the behaviour of researchers at this level?*
2. *what is the relationship between these drivers and research integrity?*
3. *how robust is the evidence for this?*
4. *what are the gaps in the literature?*

The evidence presented in this report, therefore, builds from the literature review, with specific evidence or contextualisation drawn through into this main report where relevant. A list of previous reports, such as the 2014 report of the Nuffield Council on Bioethics,[4] is included in Annex A as Table 1. The findings should also be considered in the context of the recent Wellcome report on research culture,[5] which surveyed over 4,000 researchers in the UK and globally and included almost 100 in-depth interviews. The Wellcome report is not discussed in the literature review but provides a distinct and complementary perspective on a broadly similar range of issues and questions.

In this report, as a first step, we explore the understanding of research integrity and describe awareness of some of the research integrity initiatives described in the literature review, including those at the level of funder, publisher, institution and department. Sections then move through the 'layers' from individual motivations to incentives within the local research environment, disciplinary norms, institutional processes (including institutional implementation of wider policy) and finally a discussion of incentives and systemic pressures operating within and beyond the UK research system.

4. The culture of scientific research in the UK, Nuffield Council on Bioethics
5. What researchers think about the culture they work in, Wellcome (2020)

2. Research integrity: understanding, awareness and motivation

"It's about ensuring that the research itself is trustworthy"

Publisher (interviewee)

In this section we describe awareness and understanding of research integrity at the level of individual researchers, including their perceptions of their own personal motivations for upholding (or not upholding) high levels of research integrity. As in later sections, the findings presented here are informed by interviews with stakeholder organisations, researcher workshops and a survey, and are also contextualised by the existing literature. This report summarises the main findings, with further details available in the separate annexes.

2.1 UNDERSTANDING OF RESEARCH INTEGRITY

In exploring the definition of research integrity in interviews with senior representatives of stakeholder organisations, including funders, publishers, learned societies and associations (see Annex D), two types of definition emerged: definitions focusing on 'research outcomes' and those focusing on 'researcher behaviour'. Research-focused language to describe research integrity included trustworthiness of the research, good research practice, genuine data and integrity you can rely on to build upon. Researcher-focused language included following ethical standards and behaviours, fair treatment of people, fair credit and good research conduct. For the organisations interviewed, it was clear that sophisticated and wide-reaching implicit definitions of research integrity were in operation, if not explicit definitions, and there was general agreement that research integrity encompasses all stages of the research lifecycle. Only a minority of interviewees mentioned the Concordat to Support Research Integrity definition, but in all cases it was seen as valuable.

"We have become so focused on misconduct, that as soon as somebody mentions research integrity, we immediately think about the negative, as opposed to the positive, which is what research integrity is, and stands for."

Publisher (interviewee)

Participants in the four researcher workshops (see Annex C) showed varied levels of understanding of research integrity. Some participants specifically joined the workshops to express strong views, while others wished to gain a deeper understanding of the issues. Using a virtues-based definition of research integrity allowed participants to consider potential behaviours and effects on the quality of research beyond deliberate research misconduct and fraud, which are known to be rare in academic research. Collectively, participants demonstrated a broad understanding of research integrity when asked to describe possible behaviours aligned to the virtues of research integrity[6] outlined in the concordat (see Table 2.1).

6. Workshop slides

94%
agree they understand the levels of research integrity expected of them

Research-active survey respondents, primarily based at UK universities, generally reported a high level of confidence in their understanding of research integrity. 54% strongly agreed that they understand the levels of research integrity expected of them, with a further 40% simply agreeing. Confidence levels were compared by career stage (broadly categorised as postgraduate researchers , research staff and academics), discipline (split by REF panel) and gender. Academic staff were found to be most confident, with 61% strongly agreeing. There was little difference by gender or discipline (Annex B, Section 6.1).

Table 2.1 Examples of research behaviours aligned to research integrity virtues

Virtue	Examples suggested by participants
Openness	Open peer review, openness of culture, facilitating global access to research
Honesty	Pre-registration, open metadata, good knowledge of methods (avoiding 'accidental dishonesty')
Rigour	Being systematic, having a research plan and following it, proactively seeking information
Originality	Reproducibility, giving credit for contributions
Care and respect	Cultivating diversity, guarding public trust, promotion on merit

The broad range of researcher behaviours, research processes and data, and scholarship outcomes identified align to the conclusion from the literature review that, even if fraud and misconduct ceased entirely, there would still be research integrity issues due, for example, to 'questionable research practices', poor understanding of statistics and selective reporting (Annex A, Section 7).

2.2 AWARENESS OF RESEARCH INTEGRITY INITIATIVES

58%
researchers reported some awareness or understanding of the Research Integrity Concordat

It is evident from the survey responses, though, that research integrity policy drivers and initiatives at various levels of the research ecosystem (such as global, national and institutional) are not necessarily apparent to individual researchers. For example, only 58% of research-active respondents stated that they have some awareness or understanding of the Concordat to Support Research Integrity, despite 94% agreeing or strongly agreeing that they understand the level of research integrity expected of them. Awareness was lowest for the San Francisco Declaration of Research Assessment (DORA), with over 65% of respondents saying they had never heard of it. Understandably, awareness was much higher for policies and processes with more direct implications for researchers' work flow; for instance, almost 90% of respondents said they had some awareness of their institutions' ethics processes. Institutions' processes for reporting misconduct were less well known (Annex B, Section 6.6).

7. Postgraduate researchers (PGRs) are those registered for a doctoral degree (e.g. PhD, DPhil)

54%
have some understanding of their institution's code of practice on research integrity

"The Concordats are only useful if researchers know about them and if internal policies are based on them. Our researchers don't know about most of the (above) Concordats."

Researcher developer, research institute (survey respondent)

Furthermore, only 54% of respondents had some understanding of their institution's code of practice on research integrity, with 33% knowing it exists but not the detail. Fewer research staff (45%) reported having some understanding of their code of practice than postgraduate researchers (60%) or academic staff (58%). Awareness of the Concordat to Support Research Integrity also differed by career stage, with fewer postgraduate and research staff than academic staff being aware of it and knowing the detail.

Discussions at the workshops corroborated the apparent variable levels of understanding and awareness of the various UK and international initiatives intended to increase research integrity. Overall, levels of awareness were quite low, even where initiatives may be directly or indirectly influencing researcher behaviour (for example, an increasing proportion of research papers being published open access; Annex A, Section 2.1). The full range of research integrity initiatives explored in the survey is included in Annex B.

2.3 RESEARCHERS' INTRINSIC MOTIVATIONS

99%
agree their personal integrity drives their research integrity

A consistent message from both the workshops and the survey is that researchers' personal integrity intrinsically motivates them to towards high levels of research integrity (Annex B, Section 3). 81% strongly agreed that their personal integrity drives their research integrity, with 18% simply agreeing (Annex B, Section 3.1). Furthermore, when asked how often researchers uphold high levels of research integrity, 73% of respondents believed this happened all or most of the time (Annex B, Section 6.2). Workshop participants also frequently expressed a desire 'to do it right' both to satisfy their own curiosity and to ensure that research benefits society. Stakeholder organisations acknowledged this intrinsic motivation, with interviewees noting that researchers come into the research ecosystem highly motivated to do the right thing. Survey respondents reported that, to a large extent, this motivation is also linked to their status and reputation as a researcher.

8%
researchers believe others uphold research integrity all of the time

"I think the thing to remember is that everyone, or nearly everyone, goes into science wanting to do good work. They are keen to find something out, they're not particularly motivated by money. They're excited about their subject matter."

Senior manager, sector body (interviewee)

A picture emerged, however, of tensions at the individual level between a strong sense of personal values and integrity on the one hand and the perceived systemic pressures that risk undermining these values on the other. For example, 59% of survey respondents reported that they believe (other) researchers feel tempted or under pressure to compromise on research integrity some of the time, with an additional 19% believing researchers feel tempted or under pressure to do so most or all of the time (Annex B, Section 6).

78%
researchers believe others feel tempted or under pressure to compromise some or most of the time

59%
researchers never feel personally tempted or under pressure to compromise

These tensions were also highlighted in the workshops when participants were asked to consider the virtues of research integrity and how they sit on a continuum of behaviours with corresponding vices. They were asked to consider what aspects of the research system supported virtuous behaviours in researchers and what aspects pressurised them to compromise on these. Supports included having a transparent research process and following a research plan, whereas pressures included shame over retractions, selective reporting and 'hype'. A full description of the outcomes of this activity is included in Annex C.

Although, both in the survey and the workshops, researchers acknowledged these pressures on researchers, survey respondents reported that the overall level of responding to that pressure is low; 59% of them reported that they have never personally felt tempted to compromise on their levels of research integrity. There was some variability by gender, with 39% of male respondents, compared with 29% of female respondents, stating that they felt personally tempted some of the time. There were also differences by career stage, with research staff less likely than postgraduate researchers or academic staff to report that they have never personally felt tempted to compromise on research integrity.

25% of postgraduate researchers also reported that they do not know how often (other) researchers uphold high levels of research integrity, compared with 12% of research staff and 16% of academic staff (Annex B, Section 6.2).

Although the survey samples are not directly comparable, the reported levels of pressure on researchers are similar to those described in the 2014 Nuffield Council report. This reported that 58% of its survey respondents were aware of scientists feeling tempted or under pressure to compromise on research integrity and standards, while 26% of respondents had personally felt tempted or under pressure to compromise on research integrity and standards. Research on questionable research practices suggests that individuals may give more reliable responses when reporting on others' behaviour rather than their own (Annex A, Section 7), but from the available evidence it is difficult to know with certainty what the true levels are.

"The vast majority of researchers have a struggling sense of personal and professional ethics, but this is constantly undermined by disciplinary, institutional and government drivers towards fulfilling goals and targets, even those ostensibly intended to promote ethics."

Director/head of department, university (survey respondent)

"Too difficult to 'get on' if you're honest. The constant assessment of metrics and obsession with IF and h index encourage poor research integrity"

Postdoctoral researcher, university (survey respondent

3. Local culture and people

In this section, we describe the potential incentives encouraging and discouraging research integrity that are perceived to be features of the immediate research culture. In reality, though, some of the pressures described may originate at the institutional and UK level, as well as being shaped by the cross-cutting systemic pressures seen throughout the global research ecosystem, which will be explored in later sections.

"One of the issues with research integrity is that often the principles are left to be decided or determined on a very local scale. And so, an overarching institution may have a set of guiding principles, but in practice, how that is enacted, often is down to individual labs . . . this landscape is incredibly uneven. Early career researchers have a great appetite for doing science with integrity, but how well they are supported varies enormously."

Publisher (interviewee)

As identified in the literature review (see Annex A, Section 6), local research environment and culture can have strong influences on researchers. Local cultures can be formed at departmental and institutional level. However, while many departmental environments are directly shaped by institutional practices or guidelines, they will tend to be more idiosyncratic based on the differing needs of individual departments, and on the personalities and management styles of people in senior departmental positions. Departments may also reflect disciplinary cultures and even sub-cultures within disciplines, leading to the potential for methodological and disciplinary silos. This, in turn, can shape what methodologies are favoured and what undergraduates, postgraduates and other early-career researchers learn, as well as how research integrity standards are promulgated through research groups.

3.1 BULLYING AND HARASSMENT

6% positive

5%
both positive and negative

65% negative

- perceived impact of incidents of bullying and harassment

Of the incentives explored in the survey, incidents of bullying and harassment were rated as having the most negative influence on research integrity. The majority of respondents (65%) reported a potential negative impact whilst only a small proportion (6%) reported a potential positive impact (Annex B, Section 4.9). Research staff reported a more strongly negative impact than postgraduate researchers. The survey did not ask about the frequency of bullying and harassment incidents, but free text comments illustrated perceptions that bullying and harassment are widespread and can include encouragement to take shortcuts, thereby lowering the quality of research. Respondents also mentioned bullying and harassment in relation to the power dynamic in supervisory relationships, such as overly controlling relationships limiting access to professional development and the potential to spread poor research practice.

"An atmosphere of bullying and harassment will have negative effect for many reasons. These include people being too scared to complain or raise concerns, and pressure exerted on people to publish/fudge results/hide inconvenient data."

Postdoctoral researcher, university (survey respondent)

The literature review revealed that levels of bullying in the US academic workplace are more than twice that among the general population (Annex A, Section 4.4). The recent Wellcome report on global research culture[8] reported that 43% of survey respondents (UK and international) had experienced bullying or harassment, with female respondents (49%) and those with disabilities (62%) more likely to have experienced this than men (34%).

49%
positive

25%
both positive and negative

10%
negative

- perceived impact of research leadership and management

3.2 RESEARCH LEADERSHIP AND MANAGEMENT

The importance of good research leadership in ensuring high levels of research integrity, and the potentially negative impact of poor leadership, came through strongly during the study. Survey respondents had mixed views about the influence of research leadership and management, with 19% reporting a strongly positive impact on research integrity, while a quarter reported that this can have a both negative and positive impact (Annex B, Section 4.8). Comments from the survey and interviews suggest that individuals in positions of power and influence, such as group leaders, may have an unintended negative influence due to issues concerning span of control and low direct oversight in large teams, over-reliance on proxy indicators of quality, or not having had appropriate leadership and management training. However, workshop participants also recognised that the pressures on and performance targets set for research leaders can also influence their behaviour. Research leaders setting high standards for research integrity can be good role models and have a positive influence on research practice, and this came through strongly in the survey (see Annex B, Section 4.1).

"Good management practice - from line manager to institute head - is essential for promoting research integrity . . . Even more subtle examples of poor management - such as management not being aware of good research practice themselves - has a negative impact. Good training and development can counter this."

Postdoctoral researcher, university (survey respondent)

Overall, the findings suggest that local environment and culture have a strong influence on the perceptions of, and potentially practice in, research integrity. Workshop participants described the "strong bonds" at departmental or group level, which can be resistant to institutional and wider "weak forces", whether positive or negative. Whether this influence is positive or negative depends on the attitudes and behaviours of individual leaders who can be (or may not be) role models in shaping the research practice of those around them.

8. What researchers think about the culture they work in, Wellcome (2020)

4. Relationship between research integrity and academic disciplines

This section describes respondents' perceptions of incentives that encourage research integrity and that are related to disciplinary and interdisciplinary environments and norms within the research ecosystem. Disciplines, however, are also a feature of local research environments (such as departments or research groups); differences in perceptions held by survey respondents relating to different REF panels are therefore also discussed in other sections of this report, where appropriate.

The literature review outlines how disciplinary norms both implicitly and explicitly influence researchers' behaviours: for example, implicitly by the status attached to different types of research outputs and the emphasis placed on research metrics; and explicitly by promoting the use of more openness through the use of pre-prints or data sharing. Furthermore, many disciplines have dedicated professional societies that are orientated towards practice rather than research and have established codes of conduct, as well as norms and expectations that can drive research behaviours, including by the sanctioning of inappropriate behaviours (Annex A, Section 5).

4.1 DISCIPLINARY NORMS

Generally, disciplinary influences were seen as positive. Half of survey respondents agreed that disciplinary norms had a positive impact on research integrity, while a fifth said these had both a positive and a negative impact. There was some variation by discipline, with respondents from disciplines covered by REF Panel A (medicine, health and life sciences) and Panel D (arts and humanities) more strongly agreeing that the expectations of their discipline are an important personal driver for research integrity.

Learned societies and professional bodies were also perceived to have an overall positive influence on research integrity, with 60% of respondents agreeing this is the case. However, a significant proportion of academic staff (17%) and research staff (17%) reported both positive and negative impacts, while 8% of postgraduate researchers (8%) did so. Survey comments illustrated that that societies and networks focused on specific disciplines are perceived as having a potentially strong positive influence on research integrity, although this may not always be realised in practice due to the potential negative influences of disciplinary silos or cliques of influential senior figures maintaining an unhelpful status quo.

"Disciplines can be siloed with perspectives that can hinder appreciating others' perspectives, equally they can enrich one another - the integrity/openness of the individual to alternative world-views is critical here!"

Postdoctoral researcher, university (survey respondent)

But despite the overall positive perceptions of discipline-related factors, attendance at (and registrations for) the researcher workshops highlighted ongoing differences in disciplinary conversations around research integrity. Interest in attending the workshops was much higher for REF Panel A researchers, with only 9% of attendees drawn from Panel D researchers even with promotion through arts and humanities-specific networks and preferential allocation of workshop places to these disciplines. Discussions at the workshops were subsequently biased towards data, journal article publishing and positivist approaches to research rather than, for example, scholarship, book publishing and qualitative approaches, even though the definition of research integrity is intended to apply to all forms of research.

"There is also very little recognition that arts and humanities research works very differently than research in sciences. Acknowledgment on the surface is not what is needed, it is competence of how very nuanced differences between them also translate into very different approaches of how to promote excellence in quality research."

Assistant professor/lecturer, university (survey respondent)

As described in Annex A, disciplines are, overall, in a position to strongly influence research integrity by fostering a research culture that promotes best practice. Compared to a decade ago, many more research articles contain a conflict of interest statement and a funding statement, probably partly due to publishing requirements of disciplinary journals. Journals in specific disciplines have also created incentives for research practices such as preregistration and data sharing. In this sense, disciplines have influence over research practices by requiring certain elements before publication, but they currently exert less of an influence in terms of calling out and penalising poor behaviour.

4.2 INTERDISCIPLINARY RESEARCH

Interdisciplinary research was considered a positive driver for research integrity. Workshop participants particularly noted that it requires researchers to be more open about their research. It also provides an opportunity to experience research integrity norms in other disciplinary environments. These views were echoed in the survey, with three fifths of respondents reporting that interdisciplinary research had a positive impact on research integrity, 13% reporting both negative and positive impacts, and only 3% reporting an overall negative impact. 69% of respondents also reported that undertaking interdisciplinary work personally drives them to achieve high levels of research integrity, with women (35%) more likely than men (19%) to strongly agree with this statement (Annex B, Section 4.6).

35% (female)

19% (male)

researchers strongly agree undertaking interdisciplinary research drives research integrity

"I've found that interdisciplinary research is an opportunity to spread good practice; it's rarely if ever the case that someone picks up bad habits from another discipline."

Professor/reader, university (survey respondent)

Comments highlighted the potential challenges of undertaking interdisciplinary research and breaking down disciplinary silos. They included the potentially limited knowledge of peer reviewers working across traditional discipline boundaries, leading to difficulties getting funding and published. However, comments also illustrated the potential positive impacts of undertaking interdisciplinary research, particularly when working in collaboration, due to the need to be more open about research methods, data and results, to give clear explanations and to agree appropriate practices.

4.3 EXPOSURE TO OTHER NORMS

Another theme emerging from both the workshops and the survey comments was the potential benefit to research integrity of researchers gaining wider experience beyond their local or disciplinary environment. Survey comments relating to local culture often highlighted the norms of respondents' current environment in contrast to other environments they had experienced. For example, they identified differences in disciplinary norms, in leadership and supervision styles, in accepted practices across sectors and countries, and in institutional cultures and processes. These comments highlighted the variability in local or disciplinary norms that can only be observed by moving between or working across different environments, potentially increasing how transparent the ecosystem appears for those individuals in terms of the variability of norms across different contexts.

5. Institutional processes

Here, we focus on policies and processes implemented at an institutional level. In this context, we recognise that, to some extent, the line between departmental or group culture and institutional culture can be blurred and that institutional policies are likely to be shaped by national and international influences. As the literature review revealed (Annex A, Section 4), many of the key factors that drive the behaviour of researchers, including hiring and promotion criteria and research integrity processes, operate at the institutional level.

5.1 RESEARCH STRATEGY AND GOVERNANCE

The overriding message from survey respondents' comments was that institutional strategies, governance and processes were not necessarily negative in principle, but may be disconnected from academic realities or reinforce broader systemic pressures. Discussions with workshop participants highlighted the variability of experiences across institutions, disciplines and career stages, particularly in relation to the interaction between institutional strategy and funding; this includes issues such as who is eligible to apply with respect to internal institutional pre-approval, how they are supported in their applications and what (if any) funding targets they are encouraged to meet.

*"Strategy *could* be good (rewarding and recognising conscientiousness) but is more often negative (do more research as quickly as possible)."*

Professor/reader, university (survey respondent)

36% positive

22% both positive and negative

14% negative

- perceived impact of institutional research strategies

Just over a third of respondents stated that institutional research strategies had a positive impact on research integrity, with about a fifth seeing this as both positive and negative. Just under a fifth thought they had no impact. Half of postgraduate respondents saw institutional research strategy as having a positive impact on research integrity, while only 28% of research staff and 36% of academic staff agreed with this. Two fifths of respondents stated that research governance and contractual processes had a positive impact on research integrity, while another fifth (predominantly postgraduate and research staff respondents) did not know.

"A good strategy will support healthy integrity. However, a bad one will lead to lack of transparency. It is all down to management."

Research fellow, university (survey respondent)

5.2 THE REF

Survey comments suggested that some UK-level drivers were likely to be perceived in terms of how they are implemented at an institutional or local level. For example, 17% of individual respondents saw being submitted to the REF as both a positive and a negative driver for them to achieve high levels of research integrity, with 38% agreeing and 38% disagreeing with this overall (Annex B, Section 7.4.1). This split of opinion was evident to a stronger degree for academic respondents (45%). Research staff tended to be more uncertain, with 34% agreeing that being submitted to the REF was a positive driver, 39% disagreeing and 29% not knowing.

27% positive

17% both positive and negative

32% negative

- perceived impact of REF 2021

Survey respondents also reported that REF 2021 potentially had an overall mixed impact on research integrity, with 27% agreeing it was positive, 32% seeing it as negative and 17% viewing it as both positive and negative (Annex B, Section 9.2). Workshop participants frequently noted overall negative perceptions of REF 2014. Some commenters mentioned the potential impact on research integrity of how an institution responds to the REF, for example with regard to hiring practices, with particularly strong impacts on workload models and researchers on fixed-term contracts (Annex A, Section 3.2).

"Many of these factors have both positive and negative effects. For example, the REF process puts substantial pressure on researchers (particularly ECR in vulnerable employment situations) to publish, which can lead to cutting corners and publishing too quickly"

Postdoctoral researcher, university (survey respondent)

"As an ECR the REF has caused undue stress and pressure from senior members of staff to conduct and consequently publish work that is done with less rigour more quickly to meet the REF timeline, at total detriment to the research conducted and the development of ECRs and PhDs"

Postdoctoral researcher, university (survey respondent)

5.3 LEAGUE TABLES

15% positive

17% both positive and negative

39% negative

- perceived impact of league tables

39% of survey respondents identified the existence of league tables of institutions as having a negative impact on research integrity, while 17% said the impact could be both positive and negative (Annex B, Section 7.4.1). Postgraduate respondents were considerably more likely to see league tables as positive (41%) or not to know (20%), while half of academic staff saw league tables as having a negative impact on research integrity (Annex B, Section 7.4.1). Again, institutional responses to the league tables, rather than the presence of league tables per se, were driving these negative perspectives. For example, interviewees noted the potential incentive for institutions to hide misconduct or other research integrity issues in order to protect their reputation (Annex A, Section 2.8). However, some comments also suggested that league tables could potentially hold institutions to account for poor research quality, given appropriate indicators.

"I think that researchers feeling forced to perform to arbitrary and often unattainable standards is probably the single biggest cause of unethical behaviour, and the REF, league tables, and metrics all contribute"

Research fellow (survey respondent)

5.4 CODES OF PRACTICE

As set out in the Concordat to Support Research Integrity, most research institutions have established formal ethics and integrity policies and processes (Annex A, Section 4.5). Institutional commitment to research integrity was generally seen as positive, with 63% of respondents agreeing that this drives high levels of personal research integrity and 65% reporting that their institutional code of practice has a positive or strongly positive impact. However (as discussed in Section 2), this is set against relatively low reported awareness of the existence or detail of these codes of practice.

5.5 INSTITUTIONAL ETHICS PROCESSES

Institutional research ethics committees set formal regulations and requirements on research projects to ensure they are ethically sound and also protect research subjects. There was a relatively high level of awareness and understanding of institutional ethics approval processes, with only 3% reporting they had never heard of these. Ethics processes were also perceived positively by 59% of respondents, with 12% reporting both negative and positive impacts and 7% reporting overall negative impacts. There were large disciplinary differences, with Panel B and Panel D respondents less likely to see ethics approval processes as a driver for research integrity, possibly reflecting fewer requirements for ethics approval in some of the disciplines within these panels.

"Difficult, long and complex ethics processes may make people try to sidestep processes (and) impact on integrity."

Research fellow, university (survey respondent)

Survey comments tended to be less positive and indicated that ethical review could be perceived as complex, slow or time-consuming, which was seen by some as discouraging compliance or encouraging a box-ticking approach. Some also perceived variability in outcomes of the review process depending on the individual reviewers, reinforcing discussions from workshop participants about the potential for small numbers of individuals, such as ethical review committee members, to have a large sphere of influence over research integrity. They also raised questions about whether the standards of ethical review committees were consistent across institutions and how this was quality-assured. One of the workshops discussed whether institutional ethical review processes were too narrow and should be extended to include more aspects of research integrity as well as ethical approval.

"I am a member of the University's main ethics panel and I believe that our processes do make a positive difference to research integrity. However, it is apparent from some of the applications and comments that we receive, that many staff do not see the ethics process as a positive."

Postdoctoral researcher, university (survey respondent)

50%
agreed

40%
disagreed

- they know how to report research misconduct

21% positive

23%
both positive and negative

38% negative

- perceived impact of how researchers are assessed for promotion

5.6 REPORTING RESEARCH MISCONDUCT

Most institutions will also have formal processes for reporting research misconduct. However, there was relatively low awareness of how to report instances of research misconduct, with 50% agreeing and 29% disagreeing that they knew how to do this (Annex B, Section 7.3). 43% of respondents knew that an institutional process for reporting research misconduct exists but were not aware of the details, while 22% of respondents had never heard of this process. Only 53% confirmed that they would feel comfortable raising concerns about poor levels of research integrity without fear of personal consequences, with 27% disagreeing and 13% strongly disagreeing (Annex B, Section 7.1.2).

"Institutions need to take allegations of misconduct very seriously, even if this may impact on their reputation or grant income."

Assistant professor/lecturer, university (survey respondent)

Survey comments suggested variable levels of success in gaining the trust of researchers that misconduct processes will be complied with, that whistle-blowers will be protected, or that there will be a concrete outcome from the process. There also seemed to be particular concerns about challenging more senior academics and about the potential drive for institutions to protect their reputation and that of their staff. Other comments, however, specifically noted positive experiences of using reporting processes.

5.7 EMPLOYMENT CONDITIONS

Approximately equal proportions of survey respondents agreed and disagreed overall that employment conditions and contracts were a personal driver for research integrity (Annex B, Section 7.5). This balance mostly persisted across career stages, but with more academic staff agreeing than research staff. There were no differences between the genders. Similarly, equal proportions agreed and disagreed that performance review and probation requirements drive their research integrity, with postgraduate researchers more likely to agree and academic staff more likely to disagree, with no differences between genders.

When asked about the impact of how researchers are assessed for promotion during their careers, more than a third of survey respondents reported this as a negative impact on research integrity, while a quarter identified this as both a positive and a negative impact (Annex B, Section 7.5.3). Research staff (16%) were less likely to see this as a positive incentive than academic staff (23%), and women (27%) were considerably more likely than men (19%) to see how researchers are assessed as having both a positive and a negative impact.

The literature suggests that evaluations of hiring and promotion often rely on 'outputs' such as publications and grant income, often with a focus on metrics (such as JIF and grant award value) as measures of prestige, as opposed to more qualitative measures of good research practice that would incentivise higher levels of research integrity (McKiernan et al., 2019).

16%
positive

19%
both positive and negative

37%
negative

- perceived impact of workload models

These metrics capture some elements of a researcher's contribution to research but can overlook other aspects, including quality and rigour (Annex A, Section 4).

37% of survey respondents perceived workload models as having negative impacts on research integrity, with a further 19% viewing them as both positive and negative (Annex B, Section 7.5.4). Academic staff (19%) were most likely to see this as having a strongly negative impact, with fewer postgraduate researchers (11%) and research staff (11%) doing so. 39% of male respondents saw workload models as negative, compared with 33% of female researchers, who were more likely to report workload models as both positive and negative (22%) or not to know (23%).

"A good workload model can have a positive effect, but most do not, in practice. Current institutional research strategies are too focused on money and short term "impact""

Associate professor/lecturer, university (survey respondent)

Although the implementation of workload models differs by institution, comments referred to the negative influence of unrealistic models that limit time for research: 5% of survey respondents identified themselves as 'research active' despite not having any workload allocated to research. This lack of time for research potentially leads to overwork and pressure to cut corners, particularly when combined with other institutional pressures (such as being submitted to the REF, and hiring and promotion criteria) and broader systemic pressures, as described below.

"Usually . . ., they simply allocate work proportionally, which fails to recognise that everybody in a department may in fact be overworked and that there is usually more teaching and administrative work than there are contracted hours in the week before research even enters the picture."

Assistant professor/lecturer, university (survey respondent)

5.8 PROFESSIONAL DEVELOPMENT AND TRAINING

A common model assumes that supervisors will instruct their researchers in research integrity. In many cases, however, supervisors are not trained themselves and may not feel recognised for providing this instruction. In the Principal Investigators and Research Leaders Survey (Vitae, 2017): 28% of academics strongly agreed that they are recognised and valued for their contributions to good research conduct; this is a similar proportion as for academic collaborations (24%), but significantly lower than for research outputs (45%) and securing funding (50%) (Annex A, Section 4.2).

Survey respondents, workshop participants and interviewees frequently stressed the importance of professional development and training, particularly in leadership and management skills but also in research integrity and ethics, peer-review practice, research methods and statistics, and equality, diversity and inclusion (EDI).

70% of survey respondents reported that professional development and training opportunities have a positive impact on research integrity (Annex B, Section 7.6). However, workshop participants caveated this by highlighting that where individuals are motivated or pressurised to behave poorly, they may not attend training and, if they do, their behaviour may not be improved. Furthermore, for the benefits of training to be properly realised, the local environment has to be receptive to putting the training into practice. Postgraduate researchers were more likely to have received training related to research integrity in the last five years, compared to research staff and academics, and were around twice as likely to have attended a training course on research integrity (Annex B, Section 7.6.1).

"The universities provide training that is not allowed to be used (junior academics take training seriously but then everything they try to do to follow new instructions get discarded by management). This is a huge waste of resources, time and public funding. I started avoiding training because I find it meaningless."

Postdoctoral researcher, university (survey respondent)

Table 5.1
Respondents' participation and interest in a range of training and development activities*

N=827	I have done this in the last five years		I have not done this, but I would like to	
Training topic	**Male**	**Female**	**Male**	**Female**
Online training on research integrity	44%	46%	**27%**	**37%**
Research integrity	32%	33%	**29%**	**42%**
Open publication	29%	25%	**38%**	**54%**
Open data management	26%	22%	**43%**	**57%**
Applying for research ethics approval	43%	49%	20%	25%
Publication and ethics	33%	31%	**29%**	**44%**
Statistics	44%	40%	**25%**	**32%**
Human or animal research subjects	26%	31%	**12%**	**20%**

***Notable gender differences highlighted in red (lower) and gold (higher)**

As shown in Table 5.1, although there were only small differences in participation in training on research integrity topics by gender, female respondents consistently expressed more interest in undertaking training in all these topics than male respondents. More than half of female respondents wanted training in open publication and open data management. Overall, around a third of survey respondents had participated in training and development activities related to research integrity within the last five years, with similar proportions wanting to do so. This compares to the Careers in Research Online Survey (CROS) where 39% of research staff reported having undertaken training relating to research integrity.[9] Of the list of potential training topics, survey respondents indicated open data management and open publication were the most popular topics overall for future training (Annex B, Section 7.6).

9. Five Steps Forward, Vitae (2017)

6. Systemic pressures

"I believe that the absurd low probability of success and stability in academic careers leads to enormous pressure that can push individuals towards sacrifice of integrity."

Postdoctoral researcher, publicly funded research institute (survey respondent)

This section describes (dis)incentives in the research ecosystem that were commonly perceived as systemic pressures, including those that extend beyond the UK. As described in the literature review (Annex A), academic research is a global enterprise characterised by international collaboration and supranational organisations that form part of the global research system. These organisations include funders, publishers, learned societies, professional bodies and other non-profit and for-profit organisations. The policies of these organisations can therefore have wide-ranging impact either directly on the research system and researchers or indirectly through their implementation by other organisations.

As explored above, individual researchers expressed a strong personal desire to uphold research integrity and the majority of survey respondents reported that they believed researchers do achieve this all or most of the time. This is despite significant temptations or pressures to compromise on research integrity due to a range of drivers and incentives in the research ecosystem; 78% of respondents believed researchers felt these pressures at least some of the time. These and other findings from across the study demonstrate a complex and pressured research ecosystem that at times appears to work against researchers' intrinsic motivations to practice high levels of research integrity.

Although some aspects of the research environment are perceived to have a particularly negative impact on research integrity, such as incidents of bullying and harassment, workload models and league tables, no one aspect has emerged as a single point of failure for research integrity. Rather, it is apparent that a number of pressures are embedded through the whole research ecosystem that are widely perceived to be perverse incentives, with the potential to encourage, tempt or reward poor research integrity. This study has not identified direct evidence that these perverse incentives are in fact driving poor research integrity, but it does illustrate how aspects of the research lifecycle may be vulnerable and that the balance of incentives operating against research integrity is perceived to be greater and stronger than those operating in favour of high levels of this.

"When people work in more relaxed atmospheres their work quality is better and they are happier (and in turn produce more and better). This would also yield the greatest level of research integrity. If nobody felt too much pressure, there would be no need to cut corners."

Lecturer/assistant professor, university (survey respondent)

6.1 COMPETITIVE ENVIRONMENT

Overall the research ecosystem and academic employment market are highly competitive, with fewer academic research positions than people who would like to fill them and increasingly lower success rates for funding. Competition for funding and research positions has its role to play in encouraging researchers to higher levels of achievement. However, in a highly competitive system with low success rates, the pressures on individuals to produce results may influence their behaviours.

27%
positive

25%
both positive and negative

29%
negative

- perceived impact of how project funding is awarded

As identified in the literature review, the researchers who successfully remain or advance in academia are not a random selection but those who perform well according to the assessment measures of other researchers, publishers, funders and hiring committees. Regardless of discipline, research practices will tend to be skewed towards producing the type of output that awards credit, prestige and, in turn, funding and career advancement (Annex A, Section 5.2).

If these assessment measures accurately reflect what is good for research as a whole, they can promote individual behaviours that contribute to research integrity and excellent research. However, when incentives are poorly aligned, they may inadvertently promote poor research practices. The competitive nature of research, and its inherent risk to research integrity, was a common theme in the survey comments, workshops and interviews. Survey respondents cited competition to win funding as a factor potentially leading to unethical behaviours, bullying and discouraging openness through a fear of being 'scooped'.

"Competition has its function and place if in moderate form at the right time and place in academia. But if everything becomes about competition and financial viability and in turn creates unhealthy levels of stress, it blocks a thinking mind"

Lecturer/assistant professor, university (survey respondent)

Competition is a necessary and useful feature of grant funding. But when available funding is limited and the proportion of grants awarded is low this can create an environment where the process is perceived as highly competitive, with potential downstream effects on research behaviour. Respondents were fairly equally divided on how research integrity is impacted by the way funding is awarded for specific projects and programmes. Around a quarter saw this as positive overall, with a quarter reporting this as having both a positive and a negative impact. 29% considered it negative overall (Annex B, Section 9.6). Difficulty in obtaining grant funding and the perceived institutional focus on income targets (Annex A, Section 4.4) are such that respondents described the potential temptation to focus on more "impactful", "popular" and "easier" research that is more likely to deliver within a tight time period, so that riskier but potentially important research lines may not be pursued.

Competition was not always perceived as having negative impacts. Some individuals and stakeholder organisations noted that competition can drive high-quality research. It is worth noting that the nature or quality of competition is likely to be shaped by the culture of the research group or institution, and this may lead to either positive or negative outcomes. For example, institutions with relatively competitive cultures may incentivise researcher behaviours in a way that focuses on visibly rewarded outcomes (such as publication in high-impact journals) rather than less visible but important processes such as research rigour, or fostering of good practice among colleagues and doctoral researchers.

"But it's not my, or for the most part my colleagues, lack of understanding and respect for research integrity that most undermines general research integrity- the majority of colleagues I've worked with are "for it". It's the over-emphasis and over-rewarding of competition and the under-emphasis and under-rewarding of collaboration and data checking. Again, you can make all the declarations you want- in the end, what gets rewarded gets enforced."

Postdoctoral researcher, university (survey respondent)

A commonly held belief was that, within a highly competitive environment that favours individualistic and outcome-based rewards, there were obvious advantages to be gained from 'gaming the system'. This fed a general sense of the system operating to 'unwritten rules' and being unfair and not adequately rewarding good work and working practices. An individualistic rewards-based culture inherently discourages team science and collaborative research, which were seen by survey respondents and workshop participants as conducive to encouraging research integrity.

"Research has become a zero-sum game whereby opportunities to secure funding, publications and sustained work are pitifully small and ridiculously competitive. This kind of environment, where it is all about the metrics and not the substance or legacy, encourages the cutting of corners."

Research fellow, university (survey respondent)

6.2 PRESSURE TO PUBLISH

The pressure to publish emerged as a prominent theme in every component of the study. It was perceived as an over-focus on outputs, rewards for quantity over quality, and an embedded 'publish or perish' culture, with many aspects of the research ecosystem adopting and reinforcing this pressure, leading to further competitive pressures on researchers. For example, workshop participants discussed the widespread use of metrics and key performance indicators (KPIs) for researcher assessment in recruitment, promotion and grant and fellowship applications, based narrowly on publication record. Publication in high-JIF journals has been recognised as one of the predictors of future success as an academic researcher (Annex A, Section 2.7). While publishing practices varied by discipline, participants felt that too often journal publishing exacerbated the tension between what was 'good for research' (i.e., producing quality research outputs that contribute to an accurate scientific record) and 'good for researchers' (i.e., regular publishing for career progression).

"Pressure on researchers to publish in high impact journals (for REF, for promotion etc) has a major effect on research integrity, with alas too many succumbing to develop questionable practices in research integrity."

Associate professor/lecturer, university (survey respondent)

21%
positive

19%
both positive and negative

40%
negative

- perceived impact of JIF and other metrics

Pressures were reported in relation to this perceived value of publishing in high-impact-factor journals in order to win funding, be hired and/or be promoted, despite widespread acknowledgement that JIF, h-index and other proxy measures have little relationship to research quality (Annex A, Section 2.7). Two fifths of respondents reported JIF and other metrics as having a negative impact on research integrity. Only a fifth of respondents reported these as having a positive impact on research integrity, with another fifth seeing them as having both positive and negative impacts (Annex B, Section 11.3). Male respondents (45%) were more likely to view JIF and other metrics as having a strongly negative impact on research integrity than female respondents (34%). Postgraduate researchers (36%) were more likely than research staff or academics to see these measures as having positive impacts, while research staff were the most negative about the impact of JIF and other metrics, with 48% reporting negative impacts.

Importantly, this pressure is perceived as tempting researchers to undermine research integrity, for example by making overstated claims for their research in order to publish in highly competitive journals. Questionable and unethical research practices are believed to be more likely to occur due to a bias towards publishing 'positive', 'significant' and 'exciting' results, and difficulties in publishing 'negative' or 'null' results. One interviewee described a research ecosystem where individuals come in with good intentions but get "bent out of shape" due to the pressure to publish in high-impact-factor journals for career progression.

"Anything which incentivises publication in high-profile journals (which typically require big, splashy results), especially in a metrics-driven way, incentivises bad scientific practice and publication bias."

Postdoctoral researcher, university (survey respondent)

6.3 TIME PRESSURES AND JOB SECURITY

Alongside the pressure to publish, the high workload within academia and lack of job security were perceived as creating an environment where a lack of rigour was more likely. Survey respondents reported temptation to speed up or slow down publishing their research in order to meet REF-related deadlines, with potential implications for rigour through rushing, sloppiness or honest mistakes, and implications for the openness and transparency of research if the sharing of results is restricted or delayed. Workshop participants also highlighted the increased pressure on their time to do research due to teaching or other responsibilities. Overall, survey respondents perceived workload models as potentially negatively impacting on research integrity (Annex B, Section 7.5).

Workshop participants discussed the prevalent use of fixed-term contracts for early-career researchers and the resulting employment pressures, exacerbated by the use of narrow measures of success in researcher assessment such as publication record. They raised the potential impact of short-term contracts on the thoroughness of research, through the loss of research knowledge and expertise, with researchers rushing to complete research projects before the end of their contract or leaving early to secure their next position.

Research staff responding to the survey were less likely than academic respondents to see their employment conditions and promotion criteria as drivers for high levels of research integrity (Annex B, Section 7.5).

"Young researchers are too, too often being expected to produce world-leading cutting-edge intellectual contributions on mediocre salaries, with no guarantees of work beyond the next 6-12 months. And frequently, even when they are between contracts altogether! This is what gives the perverse incentives power. There is no way I could keep to my own standards if I wasn't in the (happy) position of a permanent or at least long-term contract."

Research fellow, university (survey respondent)

Interviews with publishers, funders and other sector stakeholders further suggested that research grant funding may provide insufficient time for rigorous research integrity practices, such as data checking, curation and management, and that plans submitted during the application process may be developed with a 'tick-box' attitude and subject to little challenge or follow up.

"Most of the mentioned initiatives are quite interesting. However, for most [they are] considered a [box] ticking exercise. And it is becoming worse as further initiatives are put forward. Better research and research integrity would emerge naturally if there were less bureaucratic measures and surveys. Most of the potential issues that are emerging with research these days are solely the result of lack of time to do research in the first place."

Assistant professor/lecturer, university (survey respondent)

6.4 THE PUBLISHING PEER-REVIEW PROCESS

Overall, survey respondents rated the influence of the publishing peer-review process positively, with 64% reporting a perceived positive or strongly positive impact on research integrity. However, a further 19% said peer review had both negative and positive impacts, with more women (23%) than men (15%) reporting mixed impacts. Survey comments highlighted a variety of concerns about peer review, including a reliance on the knowledge, experience and objectivity of individual reviewers who may inadvertently encourage poor research practice by requesting, for example, changes to hypotheses, additional analyses or specific citations. Respondents also noted that the peer-review process does not always catch errors but may nevertheless be used to claim validity for the work. There were further concerns about potential undeclared conflicts of interest among reviewers who may be competitively motivated to give favourable or unfavourable reviews. Both publishers and funders noted in interviews the role and responsibility of the research community in ensuring levels of research integrity as peer reviewers.

"Peer review can be very positive but also negative if the [reviewer] has a different conception to the author or if they are working in a competing field and want to get their work published first."

Director/head of department, university (survey respondent)

71%
positive

10%
both positive and negative

3%
negative

- perceived impact of data-sharing policies

"Peer review is problematic as peer reviewers don't normally scrutinise raw data and even if they do, they don't see the actual methodology used (only a summary of what the researchers say they used). Those who would use unethical means cannot be captured via peer review and thus will use this to their advantage."

Research technician/facility manager, university (survey respondent)

"Stronger guidance about constructive peer review is something we're working on, particularly at the journal editor level... But part of the problem is of course that all of this...is unpaid, so people are doing it on top of their workload, and as a gesture of good citizenship... it seems to me like the increasing pressure on staff workloads across the UK is having a negative effect on the quality of peer reviewing."

Sector body (interviewee)

6.5 OPEN RESEARCH

Not all pressures within the wider research environment were perceived to be negative influences on research integrity. Survey respondents, workshop participants and interviewees perceived the drive towards more openness in research (Annex A, Sections 2.1 and 2.5), through open access publication, data sharing and interdisciplinary working, as having strongly positive impacts on research integrity.

71% of survey respondents reported data-sharing policies as having an overall positive impact on research integrity, with another 10% saying they have both a positive and a negative impact (Annex B, Section 11.2). Similarly, 62% of respondents reported open access publishing as having a positive impact on research integrity, with a quarter saying it has no impact or both a positive and a negative impact (Annex B, Section 11.2.1). Panel A respondents were mostly likely to agree with the benefits of these initiatives for research integrity. Panel D respondents were least likely to have a view on the impact of data-sharing policies, but were more likely than Panel C respondents to see the positive value of open access publishing.

"I think that improvements come from public scrutiny. The more open researchers are required to be the greater their 'integrity.' The measure of integrity is what we do when no one is looking, but in reality I think most of us only really do what we should when we know we will be seen doing it!"

Assistant professor/lecturer, university (survey respondent)

63%
positive

12%
both positive and negative

5%
negative

- perceived impact of open access publishing

However, despite the overall positive perceptions of openness, some comments signalled concerns such as: the specific challenges for unfunded researchers who cannot pay potentially high costs of open access publishing; concerns about the existence of 'predatory' journals; potential incentives for journals to publish research of lower quality in order to secure fees; potential 'double-charging' for the publication process and access to publications; and potential to bypass important peer-review checks on integrity by self-publishing.

"For me, there is a risk in [arts and humanities] disciplines in open access because what we're publishing is not data; it's interpretation. And sometimes interpretation with political, moral, ethical implications that are quite profound."

Sector body (interviewee)

6.6 EDI INITIATIVES AND GENDER

Equality of opportunity within academia is still a challenge. The competitive nature of academic research and unconscious biases in terms of what constitutes a 'good researcher' can lead to minority researchers feeling excluded (Annex A, Section 7). Many stakeholders and institutions have EDI initiatives. Survey respondents predominantly saw these initiatives as positive drivers for research integrity, with almost 60% of respondents agreeing this was the case; a fifth, however, reported no impact. Female respondents were more likely to see EDI initiatives as having positive impacts on research integrity, with three quarters reporting EDI initiatives as positive compared with less than half of male respondents.

"In my discipline there's a problem with people who haven't had the opportunity to learn the [discipline] at school. Really, it's about people generally from less well-off backgrounds. So, either they can't afford to fund themselves through the extensive postdoctoral desert, or they're just perceived as not being such serious researchers because they don't have the same history of learning the skills at a very early age. But I think that's a general equality and diversity problem."

Sector body (interviewee)

Throughout the survey there were strong differences between the genders in terms of how researchers perceived the impact of various initiatives on research integrity. Female respondents were more likely to strongly agree that their personal qualities – particularly their personal integrity (84%) and status and reputation as a researcher (56%) – drive them to achieve high levels of research integrity, when compared with male respondents (79% and 49% respectively).

Consistently, female respondents were more likely to strongly agree that initiatives and incentives drive them and other researchers to achieve high levels of research integrity. The five largest differences in the level of strong agreement expressed by gender were in the following areas:

- *undertaking interdisciplinary research: 40% female, 19% male*
- *sharing my research methods with others: 47% female, 32% male*
- *my immediate research environment: 41% female, 27% male*
- *working in collaboration with others: 48% female, 34% male*
- *the expectations of my discipline: 40% females, 26% males.*

Female respondents had similar views to male respondents on how often researchers uphold high levels of research integrity and reported similar levels of awareness of research integrity initiatives. There were no differences in reported understanding of the expected level of research integrity by gender, or in their feelings of being pressurised by others to compromise on their personal levels of research integrity. Female respondents were less likely to report that they felt tempted to compromise on research integrity, with 31% reporting they were never tempted compared with 24% of male respondents. Only 29% of female respondents reported that they were tempted some of the time to do so, compared to 40% of males (Annex B, Section 6).

Female respondents were more likely than male respondents to know their institutional processes for ethics approval (77% compared with 68%). However, they were less likely to feel comfortable in raising concerns about poor levels of research integrity without fear of personal consequences (16% of female respondents strongly agreed they felt comfortable doing this, compared with 25% of male respondents); they were also less likely to know how to report instances of research misconduct (46% of female respondents agreed or strongly agreed they knew how to do this, compared with 54% of male respondents) (Annex B, Section 7).

"We have research professorships . . . and we got nearly all men. And we talked to the institutions, and they said, no, there aren't many women that we can put forward, so that's just the way it is. So, we changed it to say…at least one must be a woman, and amazingly, they found all these women, and we still put them through competition. So, you're not lowering the bar for the women. They still had to compete the same with the men. So, we've now got about 50/50% male-to-female ratio as opposed to nearly all men."

Funder (interviewee)

There were few differences between the genders in terms of the level of training undertaken in research integrity within the last five years. However, female respondents were consistently more likely than male respondents to express interest in undertaking more training in all aspects of research than male respondents (Annex B, Section 7.6).

Differences were also seen by career stage in terms of the impact of various drivers. Postgraduate respondents generally were more positive than those at other career stages about how drivers and incentives impact on research integrity. This included having positive role models (with 94% agreeing this has an impact), their local research environment (85%), having their research challenged (74%), working in an interdisciplinary way (68%) and research leadership (61%). They were less likely to see incidents of bullying and harassment as impacting on research integrity (53%), compared with research staff (69%). They consistently had a more positive view of the impact of institutional and national incentives and were more likely to have received training in a range of topics relating to research integrity. However, they were more likely not to know whether researchers feel tempted or under pressure to compromise on their research integrity, with 25% of them falling into this category.

In contrast, research staff were more likely than academic staff to have a negative view of how the range of drivers and incentives impact on research integrity. They were more likely than academic staff to report that they personally felt tempted to compromise on their research integrity (43% compared to 32%). They were less likely to see institutional processes for reporting misconduct as positive (40% compared to 51%) and less likely to know how to report misconduct (36% compared to 58%) or be comfortable in doing so (47% compared to 57%). They were less likely than postgraduate respondents to understand the content of their institutional code of practice for research integrity (45% compared to 60%). Research staff were more likely than academic staff to disagree that their employment conditions were a personal driver for research integrity (48% compared to 43%), while academic staff respondents were more negative than research staff about the impact of workload models (43% compared to 34%). Academic staff respondents (57%) were more likely to see disciplinary norms as having a positive impact on research integrity than research staff (39%) and postgraduate respondents (33%). They were also more likely than research staff to have a positive view of the potential impact of REF 2021 (43% compared to 23%).

Only small numbers of survey respondents recorded a minority ethnicity, so it was not possible to do any analysis on the views of black, Asian and minority ethnic (BAME) researchers.

6.7 PUBLIC PERCEPTION OF RESEARCH AND THE MEDIA

Both the public perception of research and the media emerged as topics of discussion in the workshops, in terms of how much they influence researchers' behaviour in the context of research integrity. Everyone agreed with the value of communicating research widely and supported the recent move towards 'citizen science'. However, over a third of survey respondents reported that the public perception of research could have both positive and negative impacts (Annex B, Section 10.2).

22%
positive

41%
both positive and negative

24%
negative

- perceived impact of the media

The general view was that the press particularly could be both a positive and a negative driver for research integrity. Around two fifths of respondents (41%) identified that it could have both positive and negative impacts, with a fairly equal balance between other respondents reporting either positive (22%) or negative (23%) effects. Respondents' views on the impact of social media on research integrity were similar. Workshop participants and stakeholders recognised that journalism and social media can be positive in shining a light on research by communicating it to a wider audience or, conversely, negative if based on "biased reporting" or if investigative journalism potentially "leads to witch hunts", the later potentially "driving accountability underground". Individual researchers seeking wider profile and recognition and institutional press offices looking for "stories to tell" were both identified as potential risks to research integrity.

"You could have a strategic initiative that is intended to prevent people from using impact factor . . . but in reality people may continue to do so . . . and not even necessarily be conscious that they're doing it. So, that's the challenge, tackling the culture rather than the explicit strategy."

Sector body (interviewee)

The systemic pressures described here cannot be directly linked to any one incentive or driver operating at any one level of the research ecosystem, although the pressure to publish is fairly insidious within the whole system. The pressures are potentially reinforced both knowingly and unknowingly by all stakeholders, including researchers themselves, for example as editors, peer reviewers and recruitment and assessment panel members who may follow implicit beliefs and intrinsic ways of working that may be counter to explicit policies of funders, publishers and institutions. Nevertheless, the study drew out many suggestions on how the research ecosystem might support research integrity better, as explored in the next section.

7. Perceptions of how to improve research integrity

Throughout the study, we gave workshop participants, interviewees and survey respondents the opportunity to share their thoughts and ideas for improving research integrity. This included exploring who is responsible for research integrity, what changes might be implemented and by whom, and respondents' vision of a research ecosystem that could better support research integrity. This section synthesises those ideas.

7.1 WHO IS MOST RESPONSIBLE FOR IMPROVING RESEARCH INTEGRITY?

Survey respondents were asked to rank a list of actors in terms of who has the most responsibility for increasing research integrity. They overwhelmingly ranked 'individual researchers' as holding most responsibility, with almost half of respondents ranking them in first place. The next highest group was 'supervisors and principal investigators', followed by institutions, heads of department and research group leaders and ethics committees (joint fourth), research funders and government and policy makers (joint fifth) and publishers. Professional bodies and learned societies, and disciplinary networks, attracted the fewest votes.

"As far as I am concerned, this is all irrelevant. I and my supervisor are responsible for my own integrity."

Honorary research associate, university (survey respondent)

The results underline a belief expressed in the survey comments and through the workshops that individual researchers should take a 'researcher-focused' perspective on research integrity, with significant responsibility placed on themselves and others to act with high levels of personal integrity. However, there was broad agreement across the interviews that all actors have a role in shaping the culture of how research is carried out, with the potential to influence research integrity at all stages of the research lifecycle. Some interviewees also mentioned a tendency for organisations to underestimate the influence they have.

"Ethics and integrity can be seen as something that you do at the beginning of your research. Almost to get it out of the way. And then, you carry on with what you see as "the real work". In reality, I think integrity and ethics is an integral part of the professionalism of the researcher."

Sector body (interviewee)

Placing a high level of responsibility on the individual researcher is a fairly natural conclusion from a researcher-focused perspective of research integrity, and so is taking a research-focused definition that tends towards compliance with minimum standards. This emphasis on individual conscience as the arbiter of research integrity was a salient theme throughout the study. Alongside this recognition of the role of individual researchers was discussion of the lack of embedded rewards for research integrity within an academic reward system underpinned by publishing, which creates incentives based on research outcomes and not on the process of research.

"How much do we incentivise people going above and beyond the norm, in terms of research integrity? There is a counter argument that we expect our researchers to be honest and acute, and should just reward people for doing their job, in their professional way. But I do think we should look at how we can incentivise the positive, because currently we focus on disincentivising the negative."

Publisher (interviewee)

Efforts being made to change the reward system, for example, are discussed in the literature review (Annex A, Section 2.3). The Open Science Career Assessment Matrix is a European Commission framework intended to reward researchers who practice open research (European Commission: Working Group on Rewards under Open Science, 2017), but the challenge is to embed rewards for the levels of openness, transparency, honesty, rigour, care, respect and accountability expected of research, researchers and throughout the research ecosystem such that all stakeholders are motivated to drive high levels of research integrity.

7.2 TRUSTWORTHINESS OF THE RESEARCH ENVIRONMENT

A combination of factors appear to build up to a research ecosystem that places a significant level of responsibility on individual researchers. These must, in turn, understand the standards of research integrity expected, know how to achieve these through the appropriate institutional processes, research methods, publishing practices and dissemination, and at same time resist embedded pressures such as competition, lack of time and often insecure employment, in order to produce research of the expected quality. Although the literature examined provides some evidence on the prevalence of, for example, questionable research practices, avoidable errors and overstated claims of the evidence, there is little direct evidence for these beyond relatively low retraction rates and it is widely understood that instances of serious misconduct are rare (Annex A, Section 7). However, the evidence gathered through this study indicates overall low levels of trust that the research ecosystem is operating as it should to incentivise high levels of research integrity.

"I feel that assessing the quality of research on the outcomes and impact, and not including specific criteria by which to assess research integrity removes the focus from the process by which research is done (in terms of research integrity) to the output from it. While I haven't seen any evidence of this (and research integrity should of course be a prerequisite for all research), I fear this could create the conditions in which the value of research integrity is not sufficiently recognised or prioritised by researchers/institutions."

Researcher and researcher developer, university (survey respondent)

Highlighted through both the individual survey responses and the organisational interviews was the general absence of a culture of continuous research improvement. Such a culture would focus more on correcting and protecting the research record and may, for example,

reward article retractions as a statement of honesty and transparency, and share and openly interrogate errors, null results and 'failed' experiments for wider benefit. The current perception is of an environment that makes it difficult for individuals to adopt these ways of working within a reward system that can be seen to discourage research integrity overall. However, interviewees cautioned against a future research ecosystem that takes research integrity as a deficit model (i.e., based around weaknesses rather than strengths) and focuses only on how well individuals comply with research integrity, 'catching' instances of poor research integrity and imposing sanctions. This was described as setting up a negative culture, in contrast to a more positive culture of continuous improvement and creating a more trustworthy environment.

"One of the [research ethics] committees that I was on, we . . . adopted [NHS] processes around audit. But the way the audit was conducted was from the outset . . . about making sure that we shared best practice, and we addressed any issues. It wasn't about blaming people. It was just about improvement. It was about continuous improvement. Which I think is still the case in the NHS."

Sector body (interviewee)

This opportunity to create a more trustworthy research ecosystem that relies less on needing to trust individuals to do the right thing and more on creating an environment that values, recognises and rewards research integrity was described by many participants when suggesting what might change, and further reinforces the need for all actors to participate in changing the embedded culture in favour of research integrity.

"Having spent 30 years saying to junior researchers "this is good science, but this is what you need to do to get published" and trying to help them achieve both without compromising the integrity of their research . . . I just wish it could be different."

Director/head of department, university (survey respondent)

7.3 STAKEHOLDER VIEWS ON IMPROVING RESEARCH INTEGRITY

Workshop participants, survey respondents and interviewees were encouraged to share their ideas for making research more open, honest, rigorous, caring and accountable, which were mapped against the 'levels' of the research ecosystem. Workshop participants did not always make a clear distinction, however, between incentives operating at the individual, local or institutional level.

7.3.1 Individual level

It was suggested that researchers need to take individual responsibility for their research integrity; getting experience of and working with different research groups and across disciplinary boundaries can be empowering. Actions identified as having potential positive impacts included having mandatory training and accreditation on research integrity, having clear mechanisms for declaring financial or personal interests, and negating unconscious bias.

Survey respondents and interviewees noted a challenge for individual researchers in translating broad frameworks and policies into specific case-by-case research practice. More detailed, practical advice and contextualised guidance, as well as case study-type training, were suggested as potential solutions.

"I think the main thing to tackle would be the incentive structure, in terms of publishing, funding, promotion, etc. But ultimately the responsibility lies with the people conducting the research."

Research fellow, university (survey respondent)

All stakeholders were perceived as having an opportunity to better communicate with individual researchers around the importance of research integrity and how to get it right. However, it was often acknowledged that those who are in most need of this message may be least likely to receive it, and therefore conveying the same message across different networks and finding ways to embed research integrity messages in other contexts were seen as useful solutions.

7.3.2 Local culture

Workshop participants suggested that management training, improvements to work-life balance through a reduction in the culture of long hours, building diversity into collaborations and calling out incidents of bullying and harassment could all have a positive impact on research integrity behaviours at the level of departmental or local culture.

Interviewees suggested it is important to lead by example and be open and honest about one's own 'failings', particularly for senior researchers. At this level the span of control is small enough to be able to assess researchers through direct knowledge and not by proxies such as JIF. Performance reviews could be used partly for research integrity purposes, for example to check research approaches or whether ethical approval is needed. A culture of continued professional development and engagement with training could be encouraged.

7.3.3 Institutional level

There were further mentions of training, including leadership and management, ethics, open communication and having conversations about research integrity. Workshop participants also noted the importance of university management following research integrity principles and having proper resources for ensuring the upholding of the research integrity concordat.

Interviewees noted that within institutions there could be better communication of research integrity policies. Institutions need to provide better data management, curation and archiving infrastructure. Staff responsibilities on research integrity could be extended to include pre-publication checking and providing more training. All institutional policies that have a research integrity aspect to them, for example intellectual property rights, should be explicit about the research integrity requirements. Press releases relating to research activities should have a research integrity check. Ethical approval processes and research ethics audits could be extended to become broader checks on research integrity. All of these would have the effect of making the research system more trustworthy.

"It's worth disaggregating institutional policies, and how well those policies are then communicated, monitored and enforced."

Advocacy organisation (survey respondent)

Institutions collectively could be more active in sharing good practice and encouraging bottom-up networks. They could look at ways to ensure ethical approval processes are sufficiently robust and comparable across the sector.

7.3.4 Discipline level

Peer review was seen as a potent force in need of reform as too often it is a rushed and low-quality process because it is not recognised in workload models. Suggestions for improvement included making the process more open and transparent, having more and better training, and including reward and recognition for peer review within evaluation processes and in grants' terms and conditions.

Further potential incentives for positively influencing research integrity at the discipline level included measuring what are considered important as a discipline, having domain-specific checklists for reporting, recognising domain-specific challenges for research integrity (such as protecting the anonymity of participants in qualitative research), having discipline-based codes of conduct and withdrawing support for questionable research.

Learned societies and professional bodies should review the state of play regarding research integrity and ethical approval processes within their disciplines. More research is needed into differences in accepted behaviours across disciplines: one interviewee posited that more misconduct cases were coming to light as there was more interdisciplinary research. Attention should be paid to disciplines where research traditionally did not involve human subjects, as they may move into new research areas (such as big data or artificial intelligence) without having appropriate research integrity frameworks.

7.3.5 UK level

Interviewees recognised that the UK research system has the potential to be world-leading on research integrity due to a strong, well-connected research base. To achieve this, they suggested adopting a culture of continuous improvement, such as in the NHS, and not one based on blame. There is scope for the government and funders to lead by example by integrating research integrity into policies more effectively. The language of research integrity is very science-focused and more needs to be done to communicate with researchers in the humanities, arts and social sciences. More could be done to promote the culture of good research integrity among institutions' leaders.

"I feel like what the REF this time has done about equality and diversity has had quite a positive impact. Making the institutions come up with their own plan, and then genuinely giving teeth to actually seeing whether they're following that plan, and whether the plan is good enough. I think that really actually does make a difference. So, if something similar was done with research integrity it would become a higher priority."

Sector body (interviewee)

Workshop participants also saw a need for embedding incentives at the UK level through collective action across a range of stakeholder groups, including: government commitment to the importance of research integrity; actions by funders to increase core funding and decrease competition for grant funding; aligning metrics to research integrity; emphasising quality and peer review and a diverse range of metrics in REF and other assessments; and improving public trust through public engagement and the media.

7.3.6 Global and cross-cutting themes

At a global level, interviewees suggested publishers could act together to ensure consistent research integrity and publishing requirements and to influence training, such as in publication ethics. There is a need to increase ways of publishing promptly, such as through preprints and open research papers. Finding ways to facilitate publication of null or negative results was perceived as having a potentially positive impact. The importance of the peer-review process to research integrity should be recognised, along with the fact that it is potentially at risk from lower numbers of, and lower expertise of, peer reviewers. International collaborations pose specific research integrity challenges due to differing ethical review systems.

In improving the global research environment for research integrity, workshop participants reiterated the need for collective responsibility and action through all layers of the research ecosystem. Participants felt incentives should focus not only on driving individual behaviour but also on changing the environment and support around them. It was suggested that the aim should be 'better', not perfect, research integrity.

8. Conclusion

8.1 COMPLEXITY OF THE RESEARCH ECOSYSTEM

A consistent message from this study is that the research ecosystem is extremely complex with respect to research integrity. The findings illustrate nuanced perspectives of the different stakeholder groups, with the perceptions of the various incentives differing by career stage, discipline and gender. Furthermore, the survey comments and in-depth engagement with interviewees and workshop participants revealed a rich tapestry of caveats and contextualisation that was needed to make sense of how the various incentives are perceived, where they impact on the research system, whether they have an overall positive or negative influence on research integrity, and who might have the power to change them for the benefit of research integrity. The findings also illustrate that many of the incentives studied are themselves interconnected in complex ways and that individual researchers may not always be aware of the ultimate international or national policy drivers, even when they are aware of the consequences at a more local level.

Nevertheless, this study aimed to explore which of the potential incentives may be poorly aligned to research integrity and which may be supportive, from the perspective of the different stakeholders, and so it is possible to draw some tentative conclusions. Table 8.1 prioritises the survey data in terms of whether a range of incentives were perceived as having 'strongly positive', 'strongly negative' or 'both positive and negative' impacts on research integrity.

The distinction between incentives perceived as most strongly positive, most strongly negative or both positive and negative provides a useful starting-point for considering how to improve incentive structures so they better support research integrity. For example, future policies might aim to reinforce the positive influences of data sharing, open access, interdisciplinarity, professional development and effective leadership and management, while mitigating the negative influences of bullying and harassment, workload models, leagues tables and the inappropriate use of JIF and other metrics. Most of these perceived negative impacts go to the heart of the recognised systemic issues in the research ecosystem and will need multi-stakeholder approaches, possibly extending beyond the UK, in order to achieve significant progress.

TOP FIVE INCENTIVES FOR EACH CATEGORY AS RATED FOR THEIR POTENTIAL IMPACT ON RESEARCH INTEGRITY*

Strongly positive perceived impact:	Positive and negative perceived impact:	Strongly negative perceived impact:
Data sharing policies and requirements	Media coverage and public perception of research	Incidents of bullying and harassment
Open access publishing	Research leadership and management	Use of journal impact factor (JIF), h-index and other metrics
Interdisciplinary research	How funding for specific projects is awarded	League tables of institutions
Professional development and training opportunities	How researchers are assessed for promotion during their careers	Institutional workload models
Research leadership and management	Institutional research strategy	How researchers are assessed for promotion during their careers

*Incentives phrased as asked in the survey. To some extent negatively perceived incentives can be caveated with 'poor' or 'inappropriate' (e.g. 'poor workload models' or 'inappropriate use of league tables') but not entirely.

For those incentives that have the potential to have both positive and negative impacts on research integrity, the challenge for stakeholders, individually and collectively, is in developing policies that emphasise and incentivise higher levels of research integrity while avoiding (unintended) consequences for, and pressures on, research integrity.

8.2 TRUSTWORTHINESS OF INDIVIDUALS VERSUS TRUSTWORTHINESS OF THE SYSTEM

A strong message emerging from this study is the high level of personal integrity that researchers expect from themselves and others, and the extent to which the research system relies on this. Researchers are overwhelmingly driven to achieve high levels of research integrity by their intrinsic motivations for personal integrity and curiosity, and they see this desire to produce research of high integrity as fundamental for academic research.

By and large, individual researchers believe they are able to maintain high levels of research integrity despite perceiving a range of pressures working counter to this, such as bullying and harassment, high workloads, pressure to publish and insecure employment. However, they are less confident of other researchers' ability to resist the temptation to compromise on research integrity. To some extent this may be a result of self-selection, with individuals interested in the topic of research integrity more likely to participate in the workshops and survey. They may be predisposed to thinking that researchers not expressing an interest in research integrity are more of a risk. Conversely, it reflects the results of John et al (2012) in assessing questionable research practices, where respondents were most accurate and honest when a question was framed in terms of other people's behaviours (Annex A, Section 7). Nevertheless, for a system essentially built on trust that individuals will inherently 'do the right thing', a loss of trust in each other could have serious implications for research integrity.

"Mistakes are hidden, rather than taken as an opportunity for improving research practice and being critical as a community. Ensuring research integrity starts with recognizing that apart from a few exceptions researchers have integrity but that this does not mean they do not make mistakes that make some of their research fall shy of the very highest standard."

Assistant professor/lecturer, university (survey respondent)

Considerably more could be done to build more trustworthiness into the research system. Figure 8.1 presents the various steps in the research process and whether survey respondents perceived each of these as driving high levels of research integrity (Annex B, Section 5). For each of the steps, the policies and processes within the research system could be reviewed to ensure they are best structured to incentivise research integrity and foster a culture of continuous improvement. Participants were keen to stress that a system that values and rewards research integrity, rather than focusing on compliance, monitoring and sanctions, might have a more positive overall effect on research integrity levels.

8.3 INFLUENCE OF THE IMMEDIATE ENVIRONMENT

Throughout the study, researchers and stakeholders revealed strongly perceived views on how the people and culture within a local research environment can have strong and persistent impacts on research integrity. This was described in terms of "strong bonds" apparent at the research group, departmental or discipline level that can be resistant to more distant "weak forces" such as institutional, national and international policies. Potentially, this resistance can result in variable implementation or 'translation' of national and institutional policies at the local level, possibly due to lack of awareness or understanding, or a tendency to follow implicit beliefs and ways of working. The strong influence of (local) leaders, managers and role models was a frequent theme, with potentially positive or negative impacts on research integrity depending on the attitudes and behaviours of these individuals.

This variable implementation was also apparent at an institutional level, with individuals' perceptions of national and international-level policies and initiatives influenced by how they were implemented or communicated at the institutional level. The competitive pressure on institutions, and more importantly how institutions respond to this pressure, was believed to have a significant influence on local research cultures, for example in driving hiring and promotion practices, managing workloads and setting performance targets.

Exposure to other norms emerged as a consistent theme, with opportunities to collaborate across, or move between, different research contexts believed to have a positive influence on research integrity. Interdisciplinary working and intersectoral and international collaborations were all perceived to have overall positive impacts, despite some challenges.

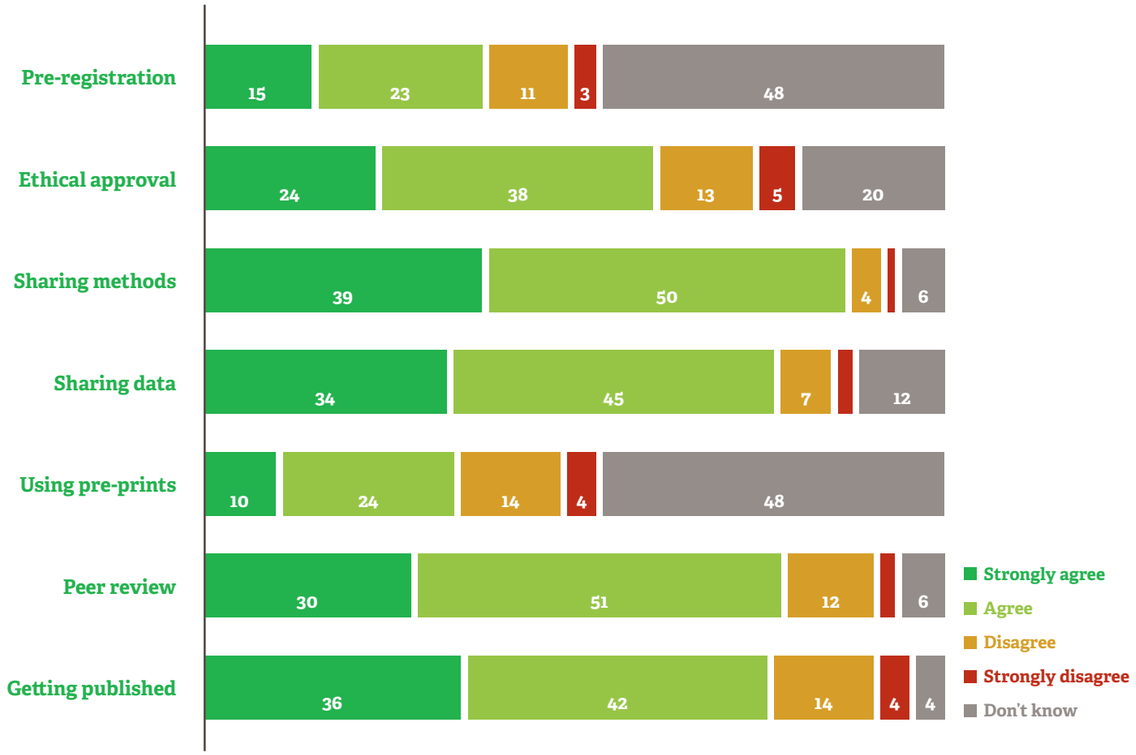


Figure 8.1
The extent to which survey respondents agree that various stages of the research process drive levels of research integrity (%, N=929)

8.4 OPPORTUNITIES FOR ALL STAKEHOLDERS

The study's final main finding is the significant opportunity for all stakeholders to contribute to and collaborate in improving research integrity within the UK research ecosystem. Individual researchers feel strongly responsible for achieving high levels of research integrity - and rightly so. But there is a clear need for more support and to provide more positive drivers to facilitate this support, including professional development and training across a range of topics such as leadership and management, integrity and ethics, research methods and statistics, and data management.

However, the findings also demonstrate that support at the individual researcher level is unlikely to be sufficient in embedding a culture of research integrity. All stakeholders involved in the study, including researchers, managers of researchers, research integrity professionals, institutions, funders, publishers, learned societies, professional bodies, other sector bodies and governmental policy makers, identified actions they and others could take to improve research integrity, and it is clear that no one stakeholder, group or individual can make significant changes in isolation. Furthermore, there is not a short-term solution; improving research integrity will take long-term concerted attention. It is important, though, that this is not perceived as a reason not to act but as a driver for sustained, multi-stakeholder effort that is likely to ensure the UK has a world-leading research ecosystem underpinned by the highest levels of research integrity.

www.ukrio.org

The UK Research Integrity Office (UKRIO) is an independent charity, offering support to the public, researchers and organisations to further good practice in academic, scientific and medical research. We promote integrity and high ethical standards in research, as well as robust and fair methods to address poor practice and misconduct. We pursue these aims through our publications on research practice, in-depth support and services for research employers, our education and training activities, and by providing expert guidance in response to requests for assistance from individuals and organisations.

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The UK Reproducibility Network (UKRN) is a peer-led consortium that aims to ensure the UK retains its place as a centre for world-leading research. This will be done by investigating the actors that contribute to robust research, promoting training activities, and disseminating best practice, and working with stakeholders to ensure coordination of efforts across the sector. UKRN works across disciplines, ranging from the arts and humanities to the physical sciences, with a particular focus on the biomedical sciences.

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