Impact of COVID-19 on the molecular biosciences community: results of the Phase 3 survey

Introduction

Since 2020 and the emergence of the COVID-19 pandemic, the Biochemical Society has conducted three community surveys exploring the impact of COVID-19 and associated disruption on researchers in the molecular biosciences. Totalling over 1300 responses across the three surveys, the feedback reflected the impact of the various lockdowns and restrictions implemented both within the UK and globally, and their ongoing effects.

Our first survey launched in April 2020 and a follow-up second-phase survey launched in October 2020. The third and final phase launched in June 2022 and aimed to explore the long-term and continued impact of the pandemic 2 years on from its emergence and following the global COVID-19 vaccine rollout. This report outlines the results of the Phase 3 survey, and comments on the consistent findings across the three-survey exercise.

Part 1: Results of the Phase 3 survey

Key messages:

Theme	Key findings
 DATA COLLECTION AND RESEARCH OUTPUT	▪ 65% of respondents were still experiencing impacts on their ability to collect data in 2022. ▪ 43% of respondents have reduced research output compared with before the pandemic, and the most reported reason for this was difficulties in effectively working in or accessing lab spaces, availability of reagents or equipment, and access to animal research facilities or colonies (46% of respondents).
 CAREER PROGRESSION	▪ 30% of early career respondents were concerned about the long-term impact of the pandemic on their career progression. ▪ The most reported causes of impact on career progression as a result of the pandemic were difficulties collecting data to progress projects or milestones (69% of respondents). ▪ 27% of early career respondents anticipated impact on career progression would be permanent.
 FUNDING	▪ 31% of respondents reported long-term challenges with grant funding due to the pandemic. ▪ 25% of respondents anticipated permanent changes to the funding landscape.

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MENTAL HEALTH

- 41% of respondents reported they had experienced an impact on their mental health, or that of their students or staff, over the course of the pandemic.
- 20% of respondents reported a long-term impact on mental health.

CARING RESPONSIBILITIES

- Long-term impacts of the pandemic on many aspects of research were reported more widely by respondents with caring responsibilities than those without.

WORKING PRACTICES

- 33% of respondents are spending more time overall working compared with before the pandemic.
- Many respondents are likely to permanently adopt working practices that were introduced over the pandemic, particularly usage of online platforms for collaboration (57% of respondents), and working from home or remotely (41% of respondents).
- 9% of respondents reported a long-term change in their research scope or focus as a result of the pandemic, and 5% of respondents have or will move away from research altogether

SUPPORT FOR RESEARCHERS

- 38% of respondents were happy with the support they received from their Principal Investigator / manager over the course of the pandemic.
- 31% of respondents were happy with support they received from their institution / organisation over the course of the pandemic.
- 47% of respondents want the Biochemical Society to prioritise provision of grants/bursaries to support researchers' recovery from the pandemic.
- 28% of respondents want policymakers to prioritise funding to support researchers' recovery from the pandemic.

Summary of results

1.1. Demographic of respondents

Of the 277 respondents:

- 52% of respondents were established scientists, of which the vast majority (89%) worked in academia.
- 25% of respondents were early career scientists, of which the majority (94%) worked in academia, and 13% of respondents were students (of which 86% were postgraduate).
- Only 7% of respondents were from industry.
- Most respondents (68%) were based in the UK.
- 48% of respondents identified as male/man, 48% as female/woman.
- 34% of respondents had caring responsibilities, with 63% not having caring responsibilities.
- 26% of respondents were funded by UKRI, 11% by charity funding, 10% by international funding and 21% by mixed funding sources.

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Fig. 1. Impact of the pandemic on research of respondents over the course of the pandemic

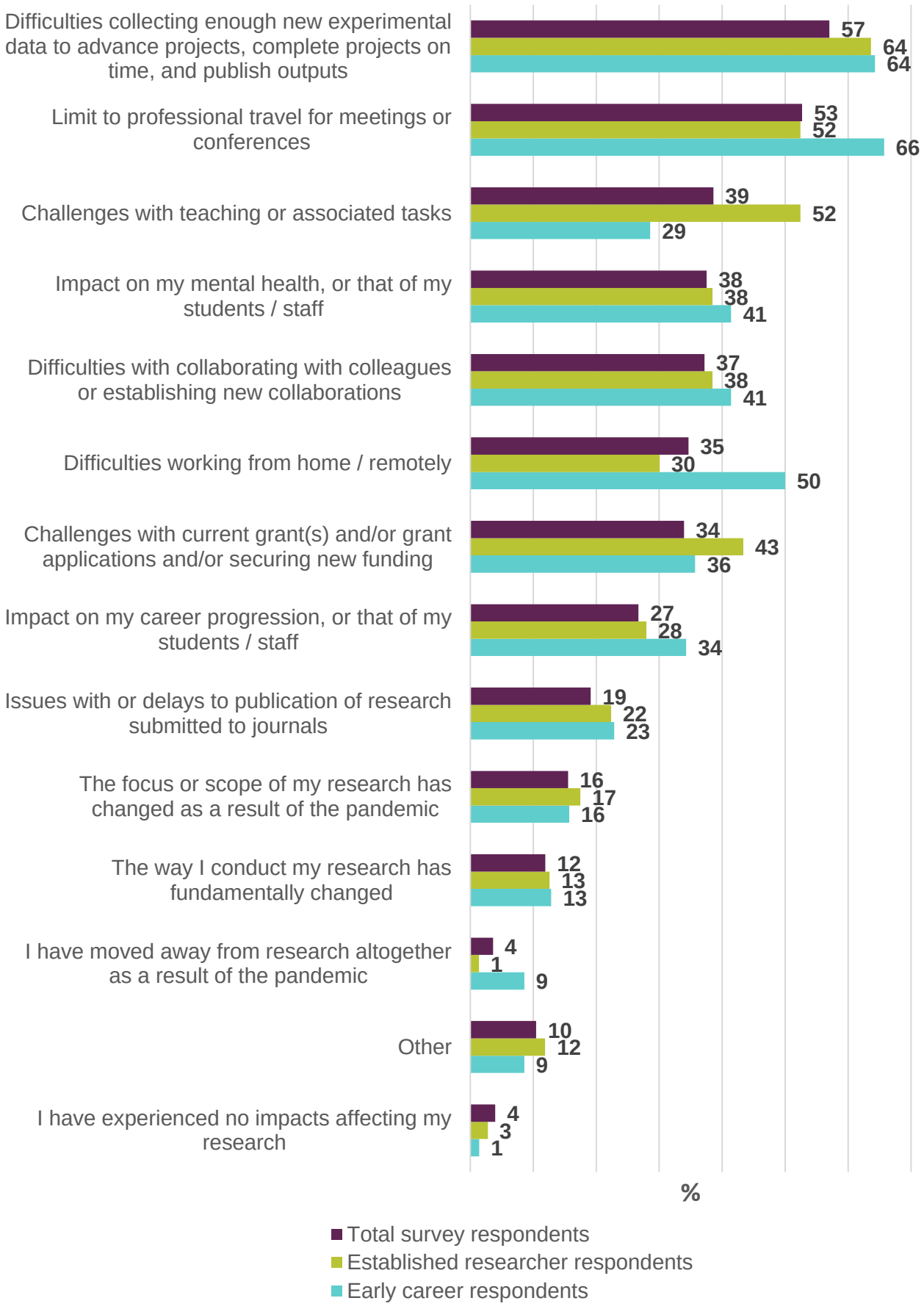

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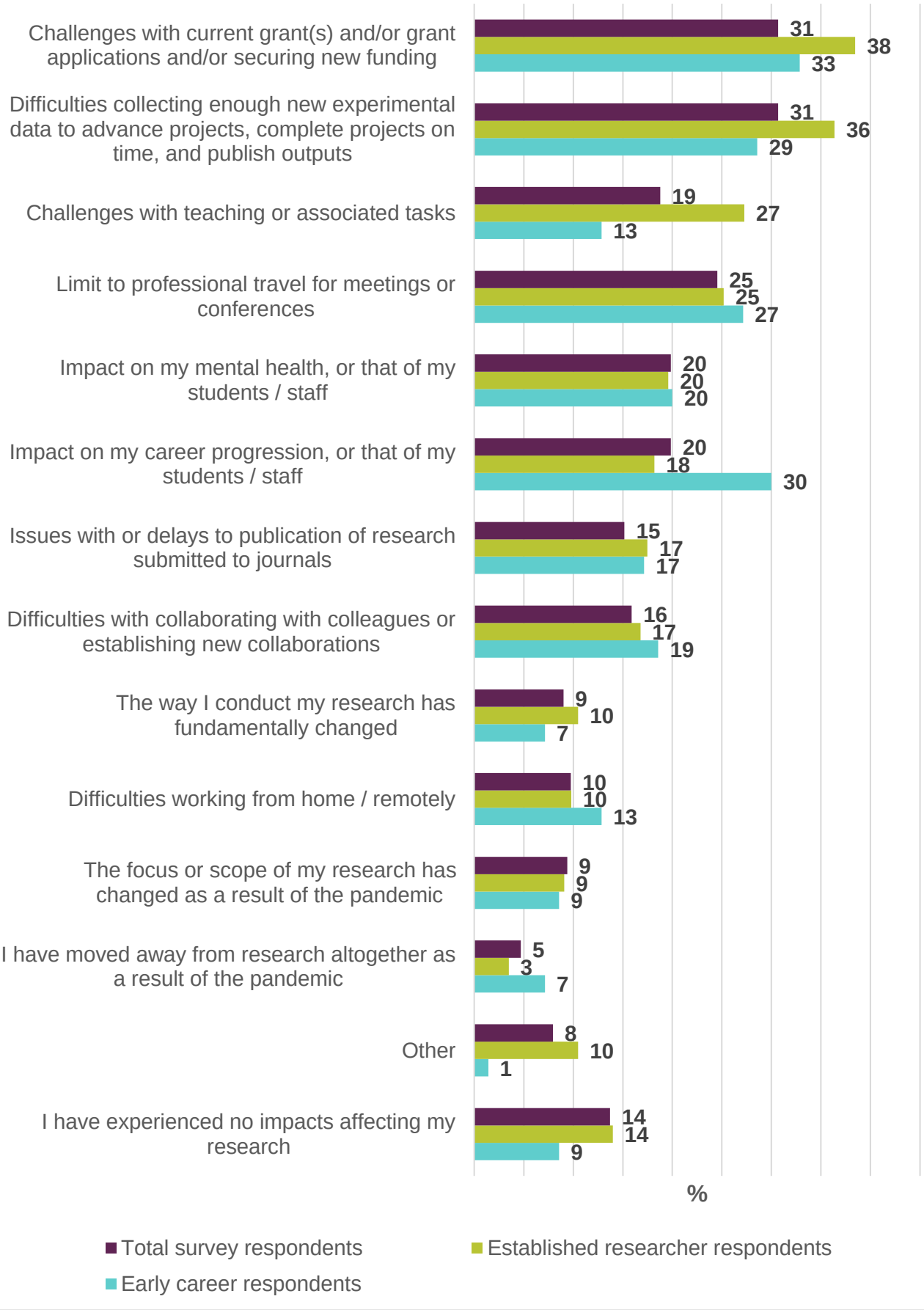
Fig 2. Long term impacts of the pandemic on research of respondents



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1.2. Impacts of COVID-19 on research / research output

There were many widely reported impacts of the pandemic on respondents' research output experienced over the course of the pandemic, and experienced or anticipated long-term. Commonly reported impacts included (**Fig. 1/2**):

- Difficulties collecting enough experimental data to advance projects, complete projects on time and publish outputs.
- Limits on travel for meetings or conferences.
- Challenges with teaching or associated tasks (particularly for established researcher respondents).
- Difficulties working from home (particularly for early career respondents).
- Impact on mental health (respondents own, or that of their students / staff).
- Challenges with grant funding.

1.2.1. Data collection and research output

Difficulties collecting enough data to advance and complete projects and publish research outputs was the most reported impact experienced by respondents over the course of the pandemic (57% of respondents) (Fig. 1) and the most reported long-term impact of the pandemic (31% of respondents) (Fig. 2)**.**

65% of respondents reported some form of impact on their ability to collect data in 2022 and, in line with this, just under half (43%) of respondents reported their research output was now either 'lower' (29%) or 'significantly lower' (14%) compared with before the pandemic (Fig. 3).

Almost half of respondents (46%) reported the reason for the impact on their ability to collect data in 2022 as experiencing difficulties in effectively working in or accessing lab spaces, necessary reagents / experimental equipment and/or animal research facilities or colonies (Fig. 4), and this increased to 56% for early career respondents (Fig. 4). Half of established researchers reported difficulties reaching research capacity due to lack of staff (e.g., absence of existing staff or difficulties recruiting new staff) (Fig. 4)**.**

Fig 3. Respondents' research output compared with before the pandemic

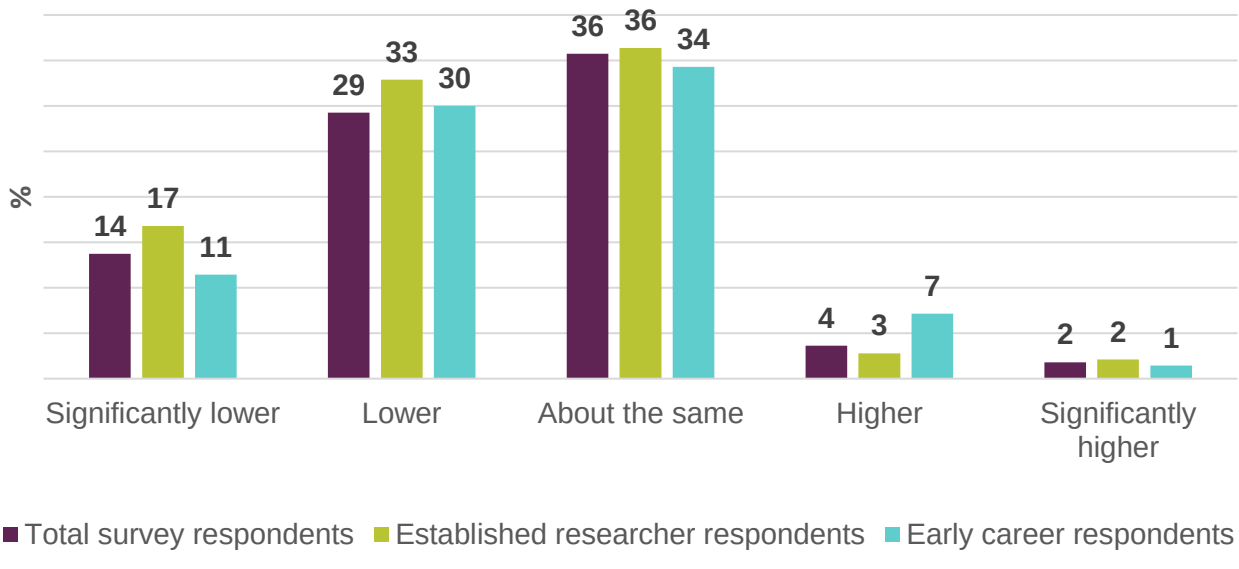
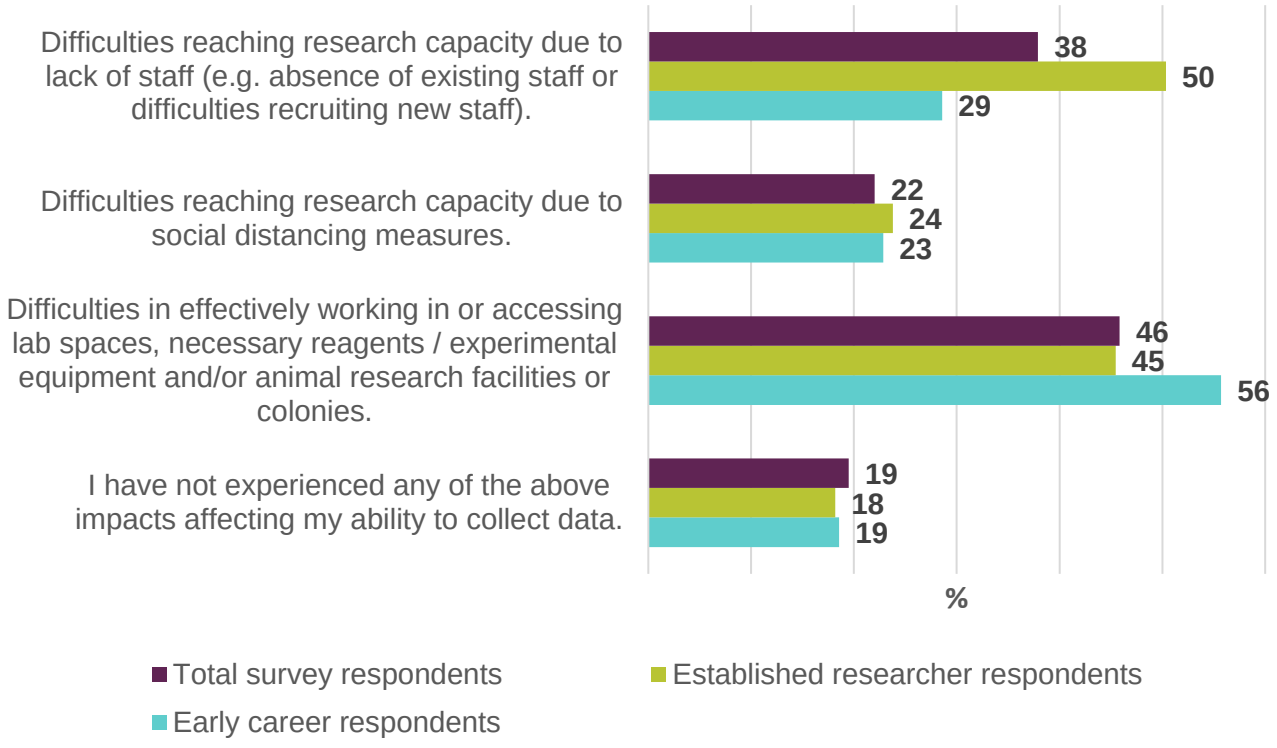


Fig 4. Impacts on respondents' ability to collect data in 2022



1.2.2. Career progression

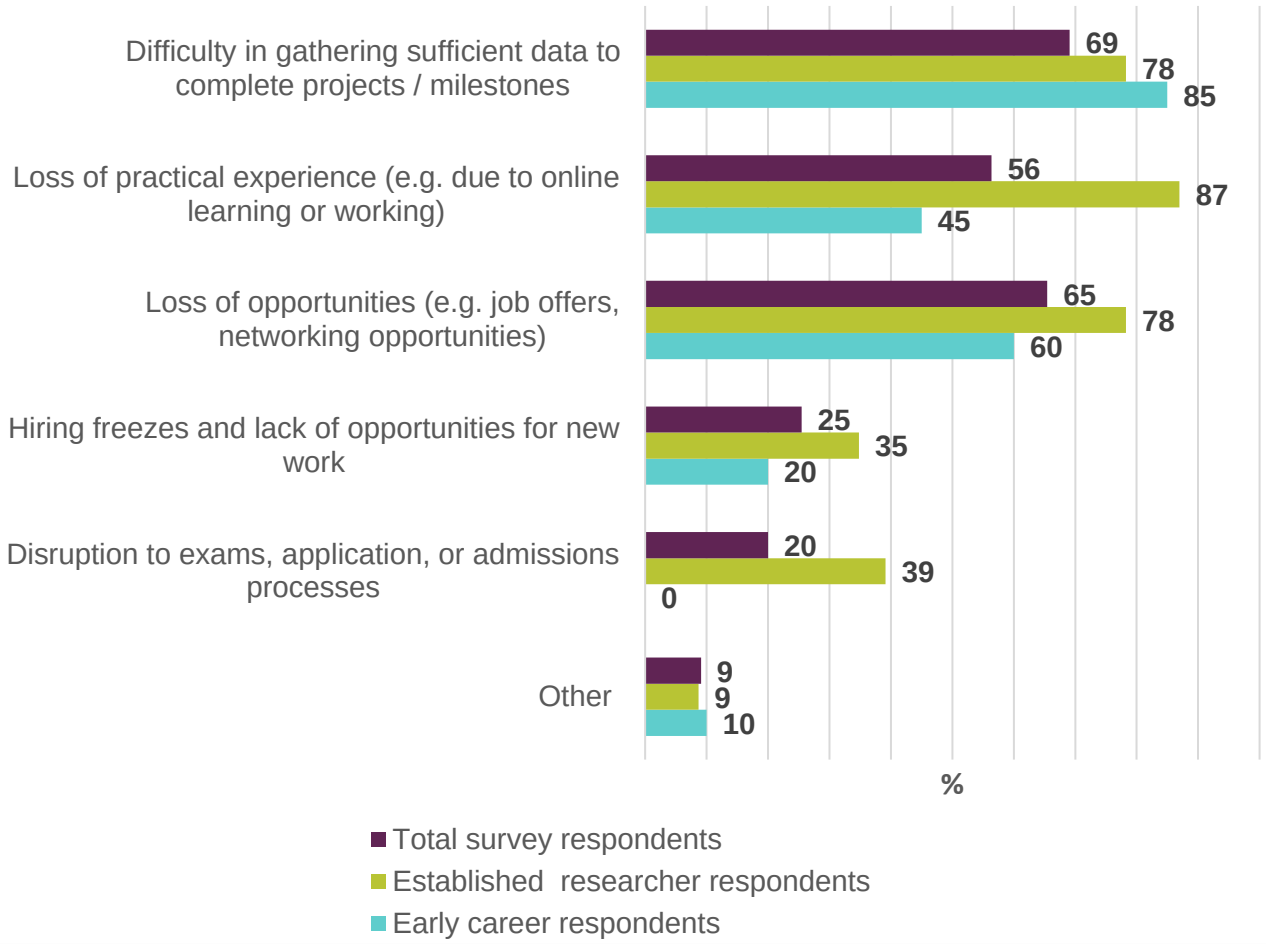
Early career scientists were much more likely to report they were experiencing or expected a long-term impact on career progression, or that of students / staff (30%), than established scientists (18%) (Fig. 2). 27% of early career respondents thought the impact on career progression would be permanent, compared to 21% of established researcher respondents (not shown).

Of the early career scientists reporting they were experiencing or expected long-term impact on career progression, or that of students / staff, 85% attributed this to the inability to collect enough experimental data to complete projects / milestones, 60% to loss of opportunities (e.g., job offers, networking opportunities) and 40% to loss of practical experience due to online learning or working (Fig. 5). Of the established scientists reporting long-term impact on career progression, high numbers also attributed this (at least in part) to the inability to collect data (78%), and to loss of opportunities (78%) (Fig. 5). Established scientist respondents were also much more likely to attribute impact on career progression to loss of practical experience due to online learning or working (87%), compared to early career respondents (40%) (Fig. 5).

Early career scientists were also more likely to report that they did not think that their institution or employer was providing enough support to mitigate impacts on career progression (25% of early career scientists either ‘disagreed’ or ‘strongly disagreed’ compared to only 11% of established researchers) (not shown). Of those early career respondents who reported long-term impact on their career progression or that of students or staff, 57% thought that their institution / employer was not doing enough to support their career progression.

To support career progression going forwards, early career respondents primarily wanted institutions / employers to provide more roles at their career level (31%), but also support with funding applications (25%) (not shown). Established researchers also wanted to see support with funding applications (22%) (not shown).

Fig 5. Causes for long-term impacts on career progression of respondents, or their students / staff



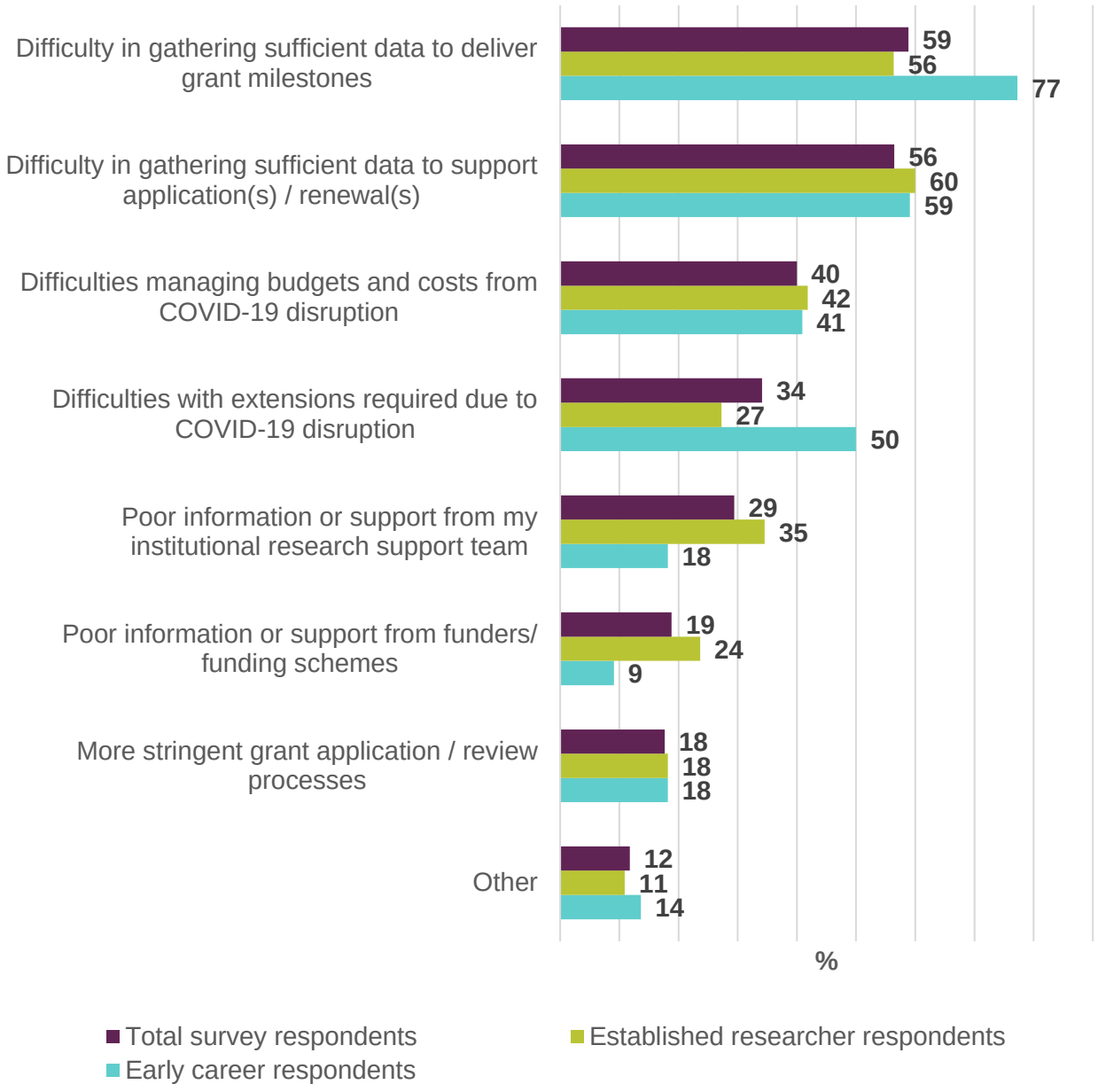
1.2.3. Funding

31% of respondents reported they are still experiencing or anticipate long-term impacts on their current grant funding or ability to secure new funding (Fig. 2), and the majority of these (65%) were established researchers (not shown). Out of the respondents reporting long-term impacts on grant funding, 59% attributed this to difficulty gathering sufficient data to deliver grant milestones, 56% attributed it to difficulty gathering sufficient data to support grant applications or renewals, and 40% to difficulties managing budgets and costs from COVID-19 disruption (Fig. 6). Early career respondents were more likely to attribute this long-term impact on funding to inability to collect data required to deliver grant milestones (77%) versus established researchers (56%) and were more likely to report issues with extensions required due to COVID-19 disruption (50%) compared to established researchers (27%) (Fig. 6).

Respondents were asked whether funder(s) are providing adequate support to mitigate the impact of COVID-19 on their grants/research funding, and of those who responded, interestingly, 41% neither agreed nor disagreed (not shown).

A quarter (25%) of respondents, increasing to 32% for established researchers, anticipated permanent changes to the funding landscape as a result of COVID-19 (not shown). Going forwards, respondents overwhelmingly wanted to see ongoing flexibility to accommodate for changing circumstances from funders (34%) with some also wanting to see a rollout of rapid-response funding systems for all grants (18%) (not shown).

Fig 6. Causes for long-term impacts on respondents' grants, grant applications or funding



1.2.4. Mental health and wellbeing

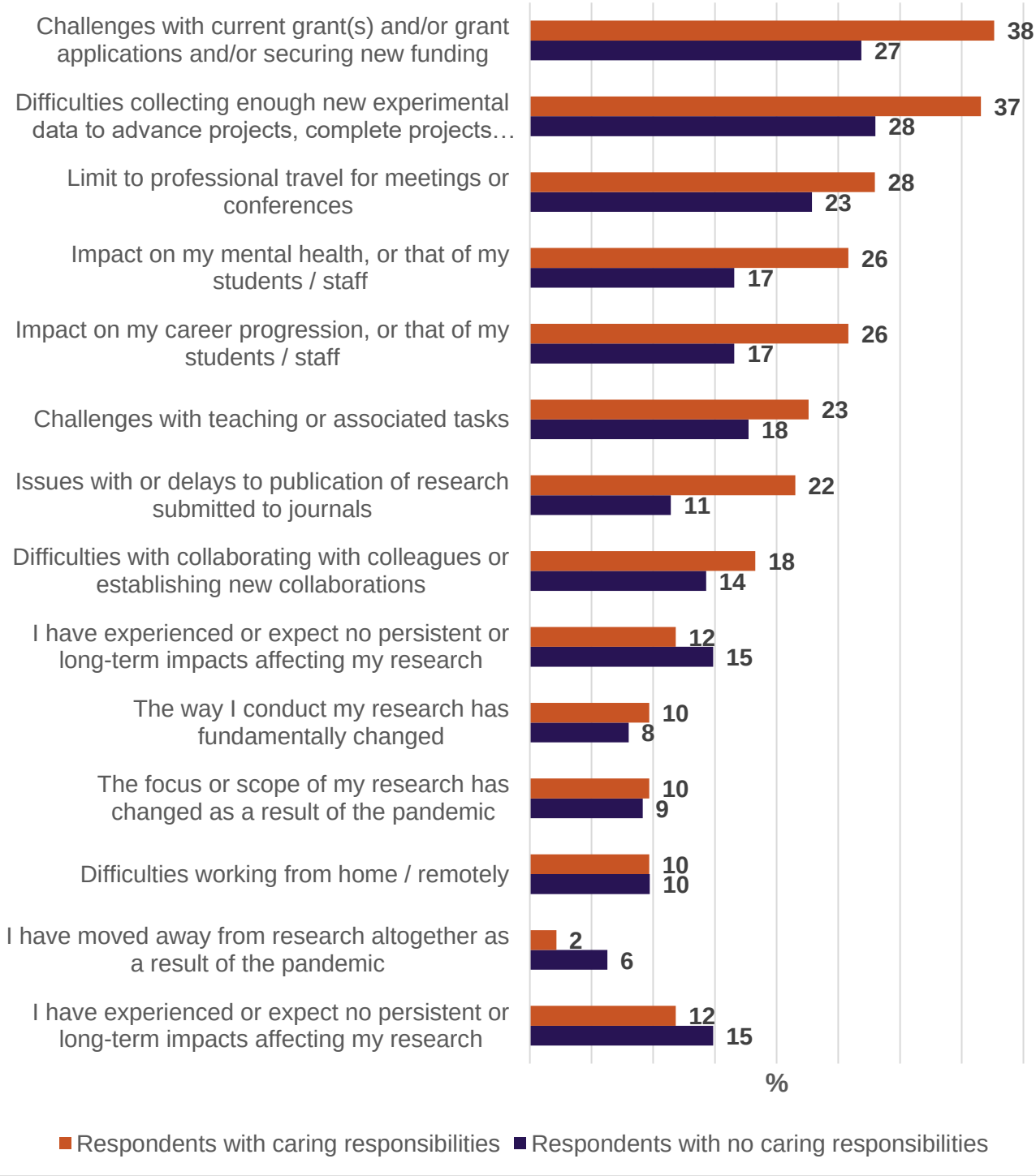
Impact on mental health, or that of students / staff, was consistently described across career stages. 41% of early career respondents reported experiencing an impact on their mental health, or that of their students / staff, over the course of the pandemic (Fig. 1), and a fifth (20%) reported mental health impact that was, or was expected to be, long-term (Fig. 2). Similarly, 38% of established scientists reported experiencing an impact on their mental health, or that of their students / staff (Fig. 1), and a fifth (20%) reported this was, or was expected to be, long-term (Fig. 2).

For student respondents, impact on mental health was the most reported impact of the pandemic; while the survey only had a small number of student respondents (37 in total) almost half of these (49%) reported they had experienced an impact on their mental health over the course of the pandemic, and 32% reported this was, or was expected to be, long-term (not shown).

Over half (55%) of survey respondents who reported they were experiencing or anticipated a long-term negative impact on their mental health did not think their institution provided adequate support over the course of the pandemic (not shown).

1.2.5. Caring responsibilities

Fig 7. Long-term impacts for respondents with caring responsibilities vs. without



Long-term impacts on many aspects of research were reported more widely by respondents with caring responsibilities than those without. This difference was particularly marked for: challenges with current grant(s) and/or grant applications and/or securing new funding (reported by 38% of respondents with caring responsibilities), difficulties collecting enough new experimental data to advance projects, completing projects on time, and publish outputs (37%), limit to their professional travel (28%), impact on career progression, or that of students / staff (26%), and impact on mental health, or that of students / staff (26%) (Fig. 7).

1.2.6. Working practices

Many respondents are likely to permanently adopt working practices that were introduced over the pandemic (Fig. 8), and there has been a change in how respondents' working time is being spent (Fig. 9), with a third (33%) of respondents reporting they are now spending more time overall working compared with before the pandemic (Fig. 9).

31% of respondents reported they are now spending more time on leadership and management responsibilities compared with before the pandemic (Fig. 9) (of these, 60% were established researchers; not shown) and 29% on teaching responsibilities (of these, 70% were established researchers; not shown). A large proportion of early career respondents are spending more time preparing fellowship / grant applications than before the pandemic (40%; not shown).

41% of respondents are now spending less time on networking and dissemination at events, and this went up to 50% of early career respondents (not shown). This is in line with a reduction in professional travel being reported as an impact of the pandemic by almost half of respondents (Fig. 1), and a quarter reported this was long term (Fig. 2). A third (33%) of respondents are likely to permanently reduce their international travel, with 22% also being likely to reduce their domestic travel (Fig. 8).

Fig 8. Adoption of working practices introduced over the pandemic on a permanent basis

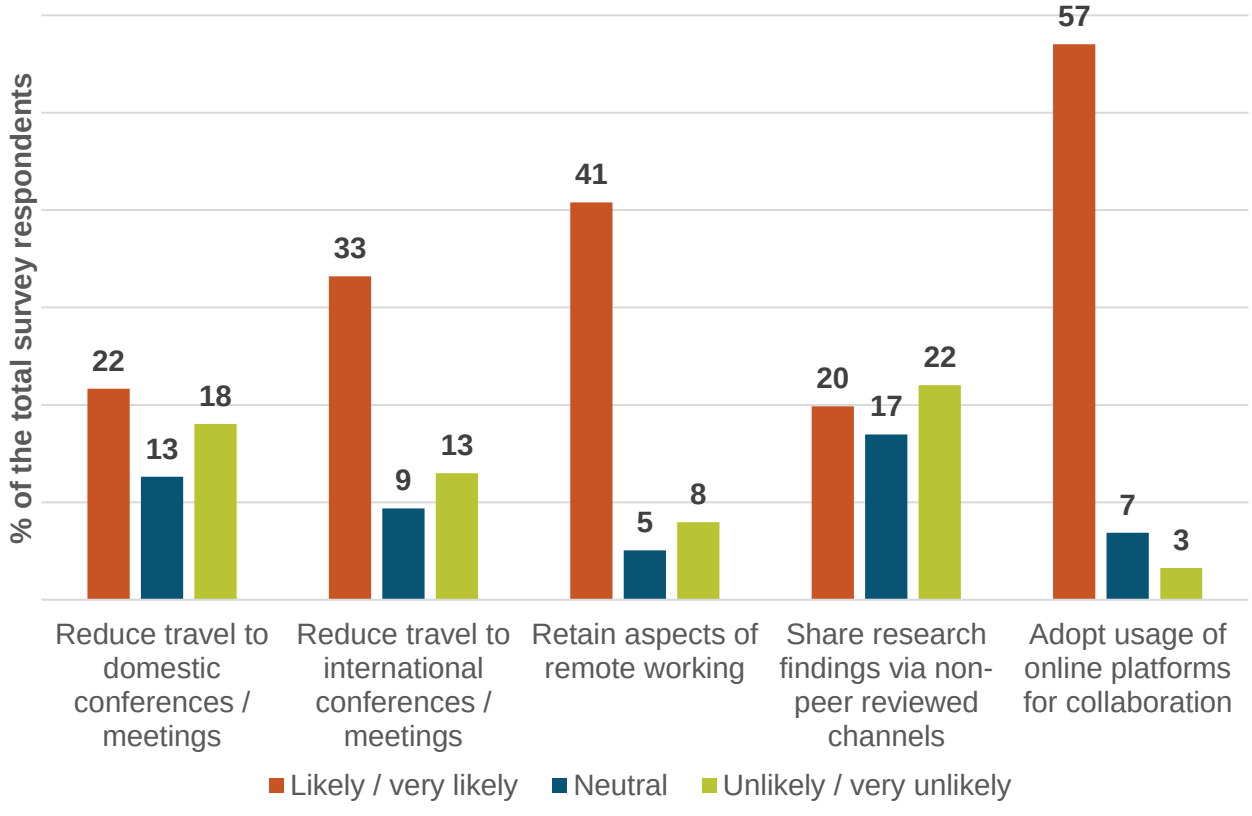


Fig 9. Changes in how respondents' time is now spent compared with before the pandemic

Many respondents are likely to adopt the usage of online platforms (57%) and working from home (41%) practices that were introduced over the pandemic on a permanent basis (Fig. 8). Only a small number of respondents reported positive impacts of the pandemic, but adoption of digital and online technologies for meetings and events was among the most reported positive impacts (10% of respondents), with improvements in accessibility (3%), efficiency (2%), and networking and collaboration (3%) specifically cited because of their use (not shown).

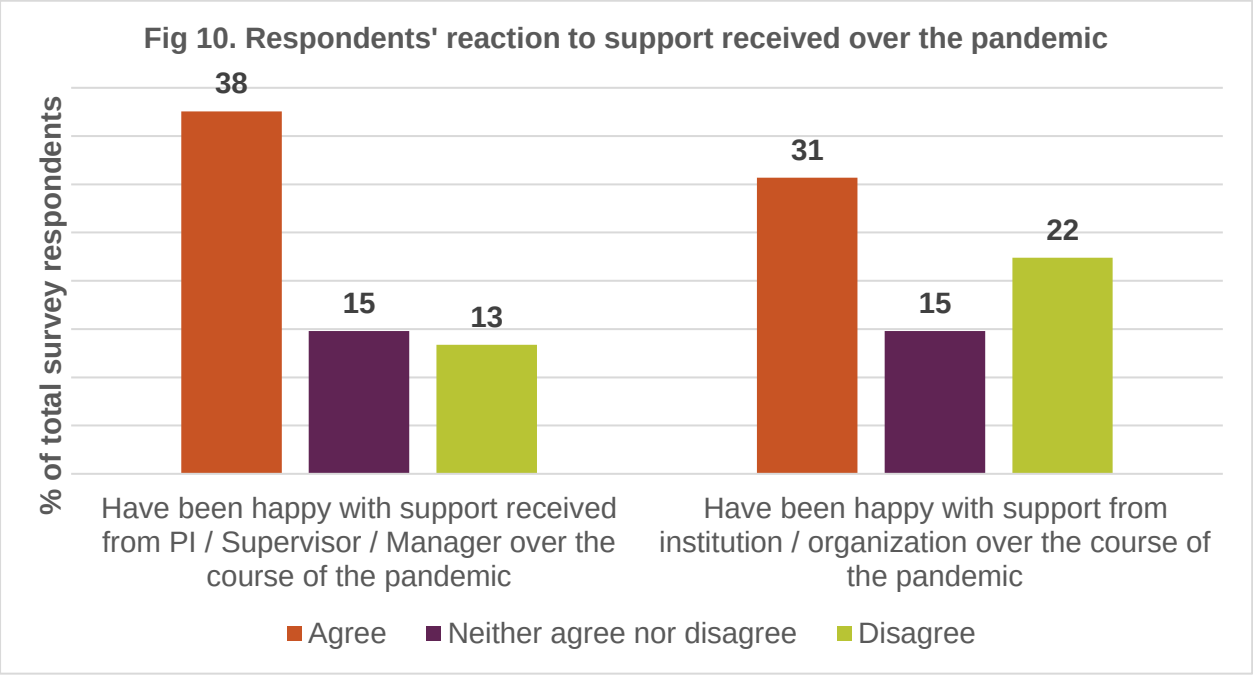
The impact of remote working and work-life balance was by far most reported as the most significant impact of the pandemic on research culture (37% of respondents; not shown) and working from home or remotely was the most widely reported positive impact of COVID-19 (11% of respondents) (not shown).

Contrastingly, difficulties working from home over the course of the pandemic were reported by over a third (35%) of respondents (Fig. 1), with early career respondents much more likely (50%) to report this than respondents who were established researchers (30%), although this impact reduced and levelled out in the long term (10% for both established and early career respondents) (Fig. 2). 40% of respondents with caring responsibilities reported difficulties working from home or remotely over the course of the pandemic, slightly more than 32% of respondents without caring responsibilities, and there was no difference in reports of experienced or anticipated long-term difficulties working from home between these groups (both 10%).

28% of respondents are spending more time planning or conducting computational and *in silico* work, which was matched by 29% of respondents who reported spending less time conducting bench work compared with before the pandemic (Fig. 8). 15% of respondents reported there had been a change to the focus or scope of their research over the course of the pandemic (Fig. 1). 9% of respondents indicated there had been or was expected to be a long-term change to the focus or scope of their research (Fig. 2), and of these, half indicated they had changed their research to include COVID-19-related research (not shown). Concern over their research being funded was by far the most common reason reported for the change in research focus or scope (42%) (not shown).

In addition, 5% of respondents indicated they had moved or would move away from research on a long-term basis (Fig. 2). Of these, 62% were early career (not shown). Reasons varied, but concerns over their research being funded and concerns over job security (both 46%) and mental health (38%) were the three most highly reported reasons (not shown). All early career respondents to this question indicated this was, at least in part, due to concerns over job security (not shown).

1.2.7. Support for researchers and shaping the future landscape

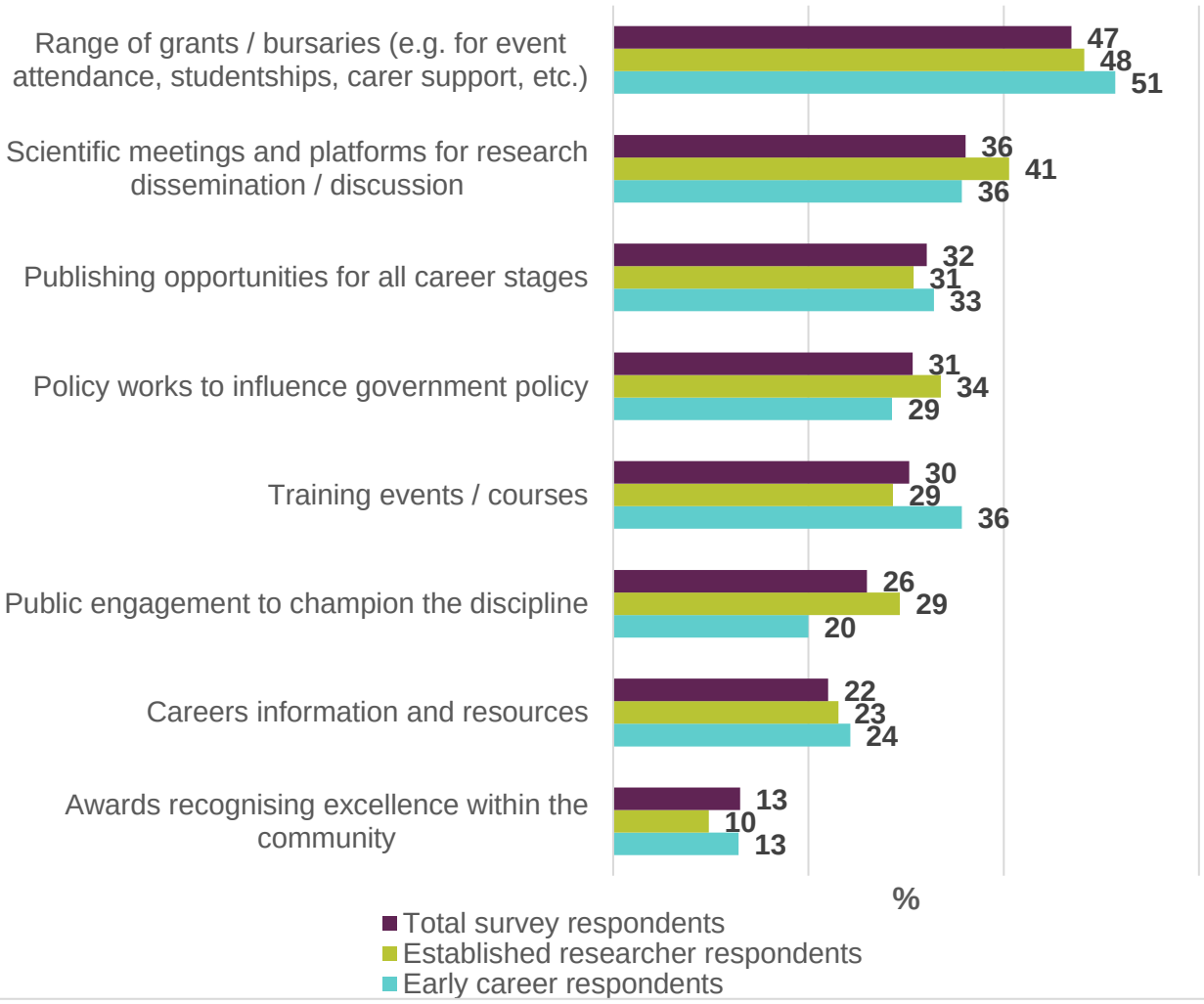


Respondents being happy with support received from PI / managers (38%) and from institutions / employers was more widely reported than being unhappy or neutral (Fig. 10). This was the case for both early career and established researcher respondents (not shown). Interestingly, there were no major differences between how respondents with or without caring responsibilities reported on the support they received from their PIs / supervisors / managers over the course of the pandemic, or from their institution or organization (not shown).

Almost half of respondents thought that delivering its range of support grants / bursaries should be prioritised by the Biochemical Society (47%) (Fig. 11). Prioritisation of scientific meetings was also reported by over a third of respondents (36%) (Fig. 11). Despite concerns around career progression, the offering of careers information and resources was not as popular with early career respondents (24%); however, 36% of early career respondents wanted to see training events and courses prioritised.

We also provided respondents with the opportunity to suggest their own ideas about the support they would like the Society to offer, and 21% of respondents to this question mentioned provision of networking opportunities (not shown). In addition, securing adequate funding for research was by far the most reported priority respondents thought policymakers should focus on at this time (28% of respondents; not shown).

Fig 11. Respondents' views on what the Biochemical Society should prioritise to support researchers and the sector



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Part 2: Discussion and conclusions from the COVID-19 community surveys

Prior to its first survey in April 2020, subsequent surveys produced by the Biochemical Society aimed to build on previous results and provide additional understanding of the impacts of the pandemic on molecular bioscientists. Our findings showcase indicative data on the impacts of the pandemic at three different points in time (soon after COVID-19 emerged, then after many of the initial lockdowns had lifted, and in 2022 after mass vaccination). Our findings are particularly indicative of the experiences of molecular bioscientists based in the UK.

The three surveys are consistent across five key areas, allowing us to draw overarching conclusions about the impact of COVID-19 on researchers:

1 - COVID-19 has damaged molecular bioscientists' productivity, with knock-on impacts for career progression and funding

Impact on research output was found across all three of our surveys. While this was completely expected in April 2020, at the time of lockdown and when many researchers were unable to access their laboratories, our October 2020 survey indicated that research output was affected even once many labs had reopened. That reduced research output has still been reported in 2022 indicates this issue is ongoing.

There are many potential contributing factors to this decrease in research output. Almost half of Phase 3 survey respondents reported experiencing difficulties in effectively working in or accessing lab spaces, necessary reagents / experimental equipment and/or animal research facilities or colonies, and established researchers reported difficulties with staffing, which may both be affected by Brexit and its effect on both supply and cost of reagents and on international researchers coming to the UK to work.

"There is a persistent impact on availability of research reagents and recruitment of postgraduate students and postdoctoral researchers, although it is difficult to separate out the impact of the pandemic from that of leaving the EU" - Established scientist (Phase 3), UK

There may also now be different demands on researchers' time, reducing available time for research amongst the many other tasks associated with academia. Our Phase 3 survey indicates that while many researchers are now working more overall than before the pandemic, some are spending less time conducting 'wet lab' work, and their time spent on different activities has changed, with some experiencing increases in teaching and managerial responsibilities. Indeed, dealing with disruption to all aspects of academic life may be acting as a drain on researchers' time and preventing them reaching pre-pandemic levels of research output.

"The increased teaching demand has taken a very heavy toll on research. In addition, the student support responsibilities have increased hugely too - all together this leaves little to no time or mental energy for research. It isn't just learning distance methods - we are supporting students who are (through no fault of their own) underprepared for university and underperforming as a result" - Established scientist (Phase 3), UK

2 - Career progression, particularly at earlier career stages, has been impacted

Concern over career progression was identified across all three of our surveys and appears (although survey questions are not directly comparable) to have peaked in October 2020 in the wake of the initial lockdowns. Again, that long-term impact on career progression is still being reported in 2022 indicates that lost research time does not appear to have been made up for with regard to career progression.

The particular impact on career progression reported by early career respondents is explained by the reported reduction in research output over the pandemic, as producing experimental results are relied upon particularly by early career scientists to allow them to publish outputs, apply for grant funding, and progress their careers. Indeed, this is likely linked to the fact that the majority of respondents who indicated they have or will move away from research in our Phase 3 survey were early career.

"[I was] judged to have underperformed without any mitigation for [the] COVID pandemic" - Early career scientist, (Phase 3), UK

However, impact on career progression, or that of students / staff, was also highly reported by established researchers, who may also be concerned for their own career progression or that of their early-career colleagues.

"[There needs to be] more emphasis on early career researchers. I suspect these are going to be the most impacted and we are at risk of losing a cohort due to loss of opportunities." - Established scientist (Phase 3), UK

"Something meaningful to recognise long-term impact on promotion [is needed]...All promotions need support from the Head of School, who actively ignores or is hostile to impact [of COVID-19] and glorifies the outputs achieved by those without caring commitments, who in turn have been wholly insensitive to colleagues impacted." – Established scientist (Phase 3), UK

3 - There has been consistent concern over the funding landscape since the pandemic hit

Concern over respondents' current grants and future funding has also been apparent in the results of all three surveys since 2020, with causes for concern over funding being consistently attributed to inability to gather sufficient data and progress projects and complete grant milestones, which in turn affect the ability to secure renewals or new grants. In the Phase 3 survey, concern over their research being funded was also cited as one of the primary reasons by respondents who had changed the focus or scope of their research, and who had moved or would move away from research.

"[There has been a] drop in funding availability in my field. It's like the taps were turned off." - Established scientist (Phase 3), UK

Other findings in our Phase 3 survey also align with overall concern over funding. For example, research funding was the most popular priority respondents' thought policymakers should be focusing on delivering, and respondents also wanted the Biochemical Society to prioritise delivery of its portfolio of grants and bursaries. Support with future funding applications was also respondents' primary choice for assistance with their future career progression.

"The biggest loss is costed time - researchers need funded extensions to complete projects and publish in order to progress with their careers" – Established scientist (Phase 3), UK

4 - The pandemic has impacted mental health

Mental health is an impact that has been shown to be important across our second and third phase surveys. Whilst mentioned by small numbers of researchers in our first survey, in October 2020, this was reported by almost half of respondents as an impact of COVID-19 in 2022.

While numbers of respondents reporting or experiencing an impact on mental health, or that of their students or staff, over the pandemic appears to have decreased slightly in 2022 (38%) compared with 2020, a fifth of respondents are experiencing or anticipating this impact to be long term. The severity of the pandemic's mental health impact is exemplified by the fact that this was cited as one of the main reasons for leaving research by those respondents who indicated they have or will move away.

"I am an academic department head - mental health of my staff and students has been impacted" – Established scientist (Phase 3), UK

5 - Introduction of remote working and online communication platforms have permanently changed the working life of molecular bioscientists

Increased levels of working from home, online meetings and events, and reduction in travel and surrounding impacts on working life were described across our surveys. Permanent adoption of these practices was anticipated by respondents in April 2020, and this was maintained in October 2020, where they were all reported as significant changes to working life by high numbers of respondents.

Overall, the introduction of regular working from home appears to have been a positive impact for respondents, with benefits including a reduction in time spent commuting and improvement in work-life balance, as well as the environment being quieter and easier to concentrate in. However, some negative impacts associated with working from home have been reported across our surveys, with difficulties working from home being reported mainly by early career respondents and those with caring responsibilities.

"What appears to be a majorly overlooked aspect is the pressures of childcare (kids off school) during the pandemic. This gave a binary effect, with some not being affected at all while others with kids are trying to effectively manage two jobs (home schooling). My wife and I have still not really caught back up to recover from this, and many colleagues (e.g., typically senior ones) who didn't have these pressures seem oblivious to the lasting effects of this." – Established scientist (Phase 3), UK

"It has highlighted that part time WFH is both possible, and a genuine benefit in terms of saving money and time and maintaining a better work-life balance."- Established scientist (Phase 3), UK

Adoption of these three working practices correlates with the overall decrease in time spent networking and meetings and events reported in our Phase 3 survey, which too could also have impacts for skills and career development, particularly for bioscientists at earlier career stages. The effect of less face-to-face contact does not appear to have affected collaboration severely; while impact on collaborations was reported by over half of respondents in our Phase 2 and a third of respondents in our Phase 3 surveys, in the Phase 3 survey only 16% reported this as a long-term impact. The impact of working from home on collaborations may be offset by widespread adoption of digital platforms and the ability they bring to connect easily to others based anywhere in the world, which was noted to improve collaboration for some respondents.

"Hybrid working has widened participation… Audio-visual infrastructure within workplace has improved, collaborators have a wider understanding and confidence with remote meetings, reduced unnecessary/time consuming travel - both commuting and moving physically between workplace sites to attend in person activities" – Established scientist (Phase 3), UK

"Networking with international researchers was somehow easier and cheaper by Zoom meetings, although it does not replace personal contact." - Established scientist (Phase 3), UK

Our response

The Biochemical Society has used the results of its three COVID-19 community surveys to inform the support it provides molecular bioscientists and the wider sector. The results of this Phase 3 survey will strengthen the understanding gained from preceding surveys, allowing us to adapt our offering to the current needs of scientists working as the developing post-pandemic research landscape is established. This work accompanies and supports ongoing work elsewhere within the Society, particularly in science and education policy and to support early career scientists, undertaken in conjunction with our Policy Advisory Panel and Early Career Advisory Panel, respectively. Findings of our surveys are disseminated to Biochemical Society committees and panels for consideration, where priorities and agendas for our different streams of work are set, and to members and relevant community partners to raise awareness of the findings and stimulate further dialogue on how the pandemic has affected the sector.

One example of action taken by the Society to address impacts highlighted by its surveys is the introduction of our early career-focused strand of our Biochemistry Focus webinar series. This has been developed in response to the results of our first COVID-19 survey in 2020, to give early career bioscientists a forum to present their research (to account for a loss of opportunities during lockdowns) and to provide career advice and training (to address reported impacts on career progression)[3]. The Biochemical Society and its Early Career Advisory Panel will continue to monitor the experiences of early career bioscientists and expand its offering for this group.

In addition, the Society has recently conducted a thorough review of its grants and bursaries portfolio, which was flagged by respondents as a workstream the Society should prioritise to support researchers' recovery from COVID-19. Based on community feedback collected via a specific survey in October 2022, changes will be introduced to the portfolio for 2023 to ensure the Society is continuing to support career development at all stages.

Our COVID-19 work adds to a growing body of evidence that demonstrates severe impacts of the pandemic on researchers, and disproportionate impacts on those at earlier stages of their scientific careers. To name an example, a survey of researchers across disciplines conducted by Vitae for UKRI in February/March 2021 also found concern over career progression amongst earlier-career researchers, poor levels of wellbeing and mental health, and reduced time for research (and therefore, presumably also a negative impact on research output)[4]. A survey conducted by Frontiers in May/June 2020 also found a large proportion of their respondents had concerns over future funding[5]. These indicate that some of the impacts we identified extend beyond the molecular biosciences and apply across the research settings in general.

It is hoped that our findings, in combination with the findings of other organisations, will spur funding bodies and policymakers at the international, national, and institutional levels to consider the impact that COVID-19 has had on the science sector and ensure continued support for the people who have been impacted.

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