European Commission

The COVID-19 Impact on GENDER EQUALITY in Research & Innovation

Policy report

Independent Expert Report

Research and Innovation

COVID-19 Impact on Gender Equality in Research & Innovation

European Commission
Directorate-General for Research and Innovation
Directorate D— People
Unit D4 — Democracy and EU values, Gender Sector
Contact Katja Reppel
Jeanne Lenders
Email Katja.Reppel@ec.europa.eu
Jeanne.Lenders@ec.europa.eu
RTD-GENDERINRESEARCH@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu
European Commission
B-1049 Brussels

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EUROPEAN COMMISSION

COVID-19 Impact on Gender Equality in Research & Innovation

Policy Report

Chair: Sabine Oertelt-Prigione

Rapporteur: Jens Peter Andersen

Directorate-General for Research and Innovation
2023 People Directorate – Gender Sector EN

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FOREWORD

The COVID-19 pandemic exacerbated inequalities in all areas of our society, and research and innovation were no exception. We witnessed a dire need for rapid public health responses and breakthrough scientific solutions for vaccines and therapeutics. This called for targeted support for the R&I community.

With the pandemic outbreak, the Commission launched the ERAvsCORONA Action Plan to coordinate European action with the Member States and to do everything possible to support research and seek synergies within the European scientific community. This was done by providing funding for clinical trials, facilitating open data sharing, and supporting the development of innovative solutions.

Gender inequalities and systemic barriers in scientific research are nothing new, but the pandemic made these inequalities more visible. This is why the Commission launched an **Expert Group to investigate the impact of the COVID-19 pandemic on gender equality in research and innovation**.

As this expert report shows, women and individuals with care responsibilities, particularly those in their early career stages, carried most of the additional workload of online teaching, student support, and care responsibilities at home and consequently experienced a **decrease in their academic productivity** – in terms of journal submissions and first authorships, compared to their male peers. At the same time, **institutional responses were mainly gender-blind**.

The European Commission has been driving structural changes in the R&I system together with Member States and stakeholders through the European Research Area (ERA) Policy Agenda 2022-2024, particularly **Action 5** (Promote gender equality and foster inclusiveness, taking note of the Ljubljana Declaration), **Action 3** (Advance the reform of the assessment system for research, researchers and institutions to improve their quality, performance and impact) and **Action 4** (Promote attractive and sustainable research careers). Still, more needs to be done to **mitigate the gendered effects of lost research time**:

First, more **data is needed** on the exact impacts of the pandemic on the R&I sector. The data available so far, though it points clearly at a widening gender gap in R&I, is patchy and prevents a reliable pan-European picture of the long-term impact. This deserves further attention at the national and EU level.

Second, in line with our work under **ERA Action 3**, we need to reconsider the criteria used to **assess and select candidates for recruitment, advancement, and funding** to ensure that those particularly affected by the changes in working modalities and the productivity decline are not penalised for career disruptions. Specific research funding schemes for these groups can contribute to that.

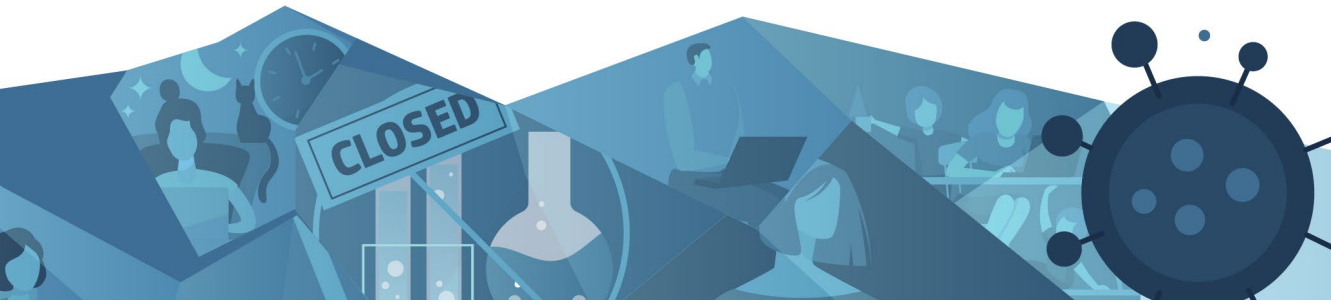
Third, after introducing **Gender Equality Plans** as an eligibility criterion in **Horizon Europe**, there is now an opportunity for R&I organisations to adapt these plans to

consider the experiences of the pandemic in policies on work-life balance, recruitment, and preventing gender-based violence.

It is my ambition that the ERA Forum, which gathers Member States, Associated Countries and EU stakeholder organisations alongside the Commission, and specifically the new **subgroup dedicated to ERA Action 5**, will play an instrumental role in applying the lessons learnt from the pandemic to ensure no research talent is left behind. All R&I actors have a role in addressing the pandemic's impact on researchers in a gender-sensitive and inclusive manner, making **R&I systems more resilient against future crises**.

I thank the Expert Group members, especially the Chair and Rapporteur, for their pertinent analysis. I strongly encourage national authorities, funding agencies, universities, and other research organisations to consider their recommendations in their policymaking. Together, we can emerge from the pandemic with a **fairer, more inclusive and gender-equal ERA**!

Mariya Gabriel
Innovation, Research, Culture, Education and Youth



EXECUTIVE SUMMARY

Research and innovation (R&I) in an increasingly complex and unpredictable world

As the world faces complex challenges, such as the climate emergency, increasing digitalisation of the labour market and rising conflicts, the R&I sector is more important than ever in understanding these developments and offering relevant solutions. These broader global developments will impact the research community as well. Europe needs an R&I sector ready to adapt to changing societal dynamics and support and make the best use of its talents. The **COVID-19 pandemic tested our ability to pivot as research-intense wealthy societies** and highlighted the risk of reversing the gains R&I has made in gender equality and diversity in the last decades. As this report on the COVID-19 impact on gender equality in R&I illustrates, social isolation, closed research facilities, reduced networking opportunities, suspension of international mobility and blurred boundaries between work and private life **exposed critical issues and inequalities** in the R&I system that were inevitably bound to emerge over time.

Academia has undergone significant changes in the last decades, shifting from a primary focus on knowledge production to a focus on skill production for the job market (Kromydas, 2017), effectively embracing a progressively neoliberal stance. Indeed, public funding for universities is decreasing, while evaluation practices are driven by narrow quantitative metrics and the ability to attract funds. One of the consequences of this shift has been the perpetuation of pre-existing inequities. For example, every year, analytics company Clarivate publishes "highly-cited researcher" statistics identifying the scientists worldwide whose work has been cited most in the preceding year (Clarivate, 2023). These numbers clearly demonstrate how the current system promotes and highlights the achievements of a narrow group of highly privileged, mostly male academics, who have established their careers in this system and designed and maintained it. Forging an academic career has been challenging for women for decades, especially if they are of colour, have care responsibilities, come from an ethnic minority group, possibly have a low socio-economic background, or are disabled. While at national and EU-level there is a growing recognition of the need to address better intersectional inequalities in R&I, concrete policies and actions to tackle these within access to academia and career progression are still limited (European Commission, Directorate General for Research and Innovation, 2022).

The COVID-19 pandemic has tested the R&I sector's resilience to future crises. Many of the inequalities which the COVID-19 crisis exposed and aggravated are likely to affect the same individuals in the future. Hence, this report offers a critical analysis of the last three years and proposes mitigation measures for making the European Research Area (ERA) and R&I globally more inclusive, gender-equal and resilient in the future.

EU policy support for gender equality in research and innovation

As detailed in the latest She Figures 2021 report, structural barriers continue to hinder women's full inclusion in R&I careers in the ERA. Although women's participation in academia at all levels is increasing, the developments, especially at the highest career levels, are still not gender balanced. While the She Figures report shows slightly more women university students and more women PhD graduates in the health, welfare, and education fields (60% and 67%, respectively), the representation of women PhD graduates still lags behind in fields like Engineering, Manufacturing and Construction (29%) and Information and Communication Technologies (22%). On top of that, women are significantly underrepresented in leadership, such as in full professorships or equivalent positions (26%). While these differences in leadership representation display significant country differences (from 13.3% in Cyprus to 50.8% in Romania), overall the numbers exemplify a loss of talent and diversity in career progression in academia (European Commission, Directorate General for Research and Innovation., 2021).

The European Commission has promoted institutional change for over a decade by implementing Gender Equality Plans (GEPs) at R&I organisations, which have become an eligibility criterion in Horizon Europe. Furthermore, **Action 5** of the European Research Area Policy Agenda, '**Promoting gender equality and fostering inclusiveness**' (European Commission, Directorate General for Research and Innovation, 2021), defines four key priorities, including the development of inclusive gender equality plans and policies, combating gender-based violence in academia, intersectionality-informed gender mainstreaming and the development of principles for evaluation of the gender dimension in R&I content. A dedicated subgroup, composed of representatives from Member States, Associated Countries, and stakeholder organisations, was set up in March 2023 to help implement ERA Action 5. In addition, work is ongoing under **ERA Action 3** to 'advance towards the reform of the assessment system for research, researchers, and institutions to improve their quality, performance and impact'. In line with this, an '**Agreement on Reforming Research Assessment**' has already been signed by the Commission and stakeholders to better recognise diverse research outputs and activities, basing assessment primarily on qualitative judgement and moving towards a more responsible use of quantitative indicators (CoARA, 2020). A Coalition (CoARA) among the signatories has been set up to support the implementation of these commitments.

To inform these ongoing efforts, in December 2021, the European Commission established an **Expert Group**, funded under Horizon Europe, and tasked with producing a report identifying the effects of the **COVID-19 pandemic on gender equality in the R&I sector** in the ERA. The group´s mandate was to report on the consequences of the COVID-19 crisis and the pandemic containment measures put in place at institutional, national and EU level with a specific focus on the work and productivity of women researchers and the consequences of the pandemic for gender equality in the EU R&I system in general.

The international expert group included 12 professionals with diverse and complementary expertise in the field of gender in academia, who compiled this

report in 2022. The experts were divided into four distinct working groups, each addressing topics that contributed to chapters of the report. In their data collection process, they drew upon scholarly literature, grey literature, and their personal expertise as members of several ongoing EU projects in the field of gender mainstreaming. The result is subchapters integrating broader international perspectives with national or local good practice examples.

The report is aimed at national and EU-level authorities, R&I umbrella organisations, and individual research performing and funding organisations in EU Member States and Associated Countries of Horizon Europe. It should support these actors, including the Commission with adopting the lessons learnt from the pandemic in its R&I policies, particularly under the ERA and Horizon Europe, by providing an additional focus on the gendered inequalities exacerbated by the pandemic.

Impact of COVID-19 on gender equality in research and innovation

This report is divided into four chapters highlighting from different perspectives how the COVID-19 pandemic aggravated existing inequalities in the academic system. Starting from the impact of the pandemic on existing practices in the R&I system, the report then focuses specifically on the situation of early career researchers (ECRs). Subsequently, the broader implications of the neoliberalisation of the academic system in a context of crisis and the persistent data gaps that impede a more inclusive incorporation of the gender dimension are discussed.

Chapter 1 focuses on changes in **academic publishing practices** during the pandemic to speed up and open up the availability of research findings, the transition to digital work and meeting environments, and **institutional responses** to the changes required by the pandemic, such as a transition to **digital learning and teaching**.

- When the pandemic started, available publishing practices mostly favoured established researchers, who could rapidly pivot and re-focus their work on COVID-19. Open access practices, such as the **publication of pre-prints** and **open data sharing**, were embraced more prominently overall. However, established researchers who could focus on COVID-19 emerged most successfully from the pandemic due to increased exposure and attraction of research funds.

- Many work activities and conferences were moved online, increasing accessibility compared to physical events to some extent but also reducing the opportunity for spontaneous social interaction to the **detriment of junior and less well-connected researchers** who could not establish novel collaborations.

- **Institutional responses** to the pandemic mostly ignored gender aspects, not considering traditional labour divisions along gendered lines. Mitigation measures were mostly generic and did not specifically target the most disadvantaged groups – those with multiple care responsibilities who already had less access to resources.

Chapter 2 highlights the specific impact of the pandemic on **early career researchers** (ECRs). Early career researchers are in a vulnerable and highly dynamic moment in their career, and the pandemic strongly impacted their productivity, access to resources and mobility.

- Early career researchers, especially those with concomitant care responsibilities and/or working in resource-intensive fields, who tend to be women, were affected most. **Care responsibilities** at home reduced the time available for research work, while lockdowns prevented these researchers from accessing the facilities where they could conduct their work. This had a **significant impact on the productivity**, in terms of journal submissions and publications, of this group.

- Mobility is an essential requirement of research careers, fostering professional **skill development, network building** and **career progression**. The pandemic limited mobility opportunities for many ECRs, who might struggle in the future to make up for these lost years. Given that mobility has to be potentially negotiated with a partner, combined with childbirth and care responsibilities, and economically supported, women and minority academics will likely face the most significant consequences of three years of curtailed mobility.

Chapter 3 places the developments described in the first two chapters in a broader systemic context. While chapters 1 and 2 focus more on the inner workings of academia, this chapter provides a broader perspective on the consequences of the neoliberalisation of academia in the context of crisis. It focuses on care responsibilities and their distribution along gendered lines, **new working modalities** during the pandemic, **gender-based violence in academia**, and the impact of the pandemic on **work-life balance** and **well-being**.

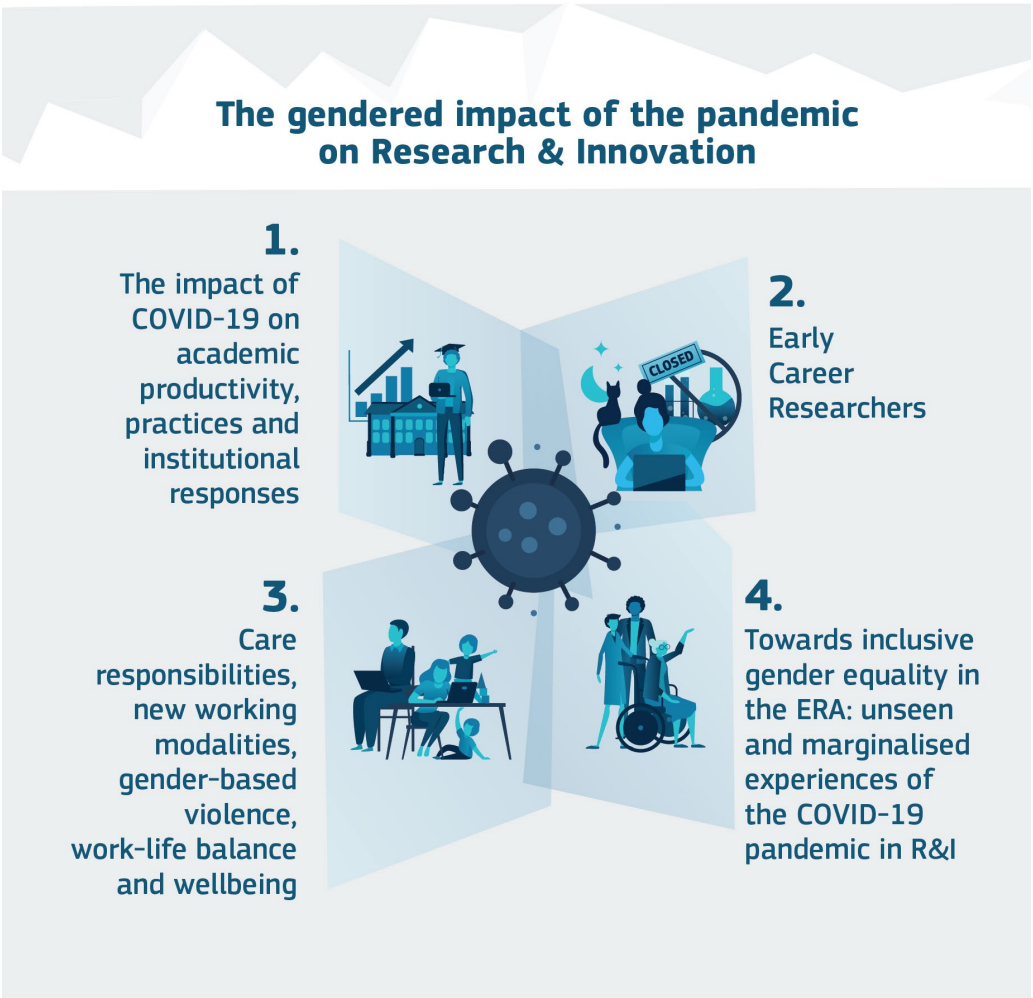
- Many institutional interventions during the pandemic did not take gender into account. This prevented selective support measures from reaching the researchers (primarily women), who would have needed them most. While **digital, teleworking and smart working** could offer researchers more flexibility, the blurring of work and personal life became a disadvantage, particularly for those engaged in care activities.

- Gender-based violence increased overall during the pandemic; however, the specific impact in the research field is one of the most striking gaps in the research so far.

- The most burdened researchers, such as women facing a high care burden, single parents, and disadvantaged researchers, experienced the **highest incidence of stress** and **negative impact on their well-being**.

Chapter 4 addresses **intersectional aspects** for which currently data is lacking. In addition to gender, COVID-19 may have exacerbated the inequalities experienced by some of those groups of researchers exposed to other sources of discrimination, such as disability, ethnicity, and socio-economic background. This

chapter lists some of the information needed to develop **targeted interventions** for addressing intersectional inequalities in R&I in the future.



Challenges faced

During the development of the report, the contributing experts encountered multiple data gaps, which limited the ability to formulate extensive recommendations in some areas. While statutory surveys about the participation of women academics in the research process, such as She Figures, are available, specific details about the impact of COVID-19 on this group are harder to find. Intersectional data are lacking, often forcing the researchers to aggregate all women and men researchers into one group without the opportunity to highlight significant differences within the group. Furthermore, some research areas are still neglected, such as the impact of gender-based violence in academia during the pandemic, including online harassment. Last, although some good practice examples for mitigating inequity could be identified, their number is very low, and the examples often only encompass local interventions with limited outreach.

General recommendations

The report clearly demonstrates how the pandemic penalised women academics, particularly those in their early career stages, and researchers with care responsibilities. Labour division along gendered lines was a main driver of these developing inequities. Many mitigation measures enacted by universities and funding agencies did not consider this reality, further penalising the most affected individuals. Established researchers experienced a visibility bonus, while early career researchers were limited in their access to resources and forced to curtail their mobility plans, potentially limiting their future career prospects. Smart and digital working options increased access and flexibility but also limited the establishment of new networks and blurred the lines between work and private spaces. Data gaps still exist, especially on intersectional aspects, different forms of discrimination in academia, and the impact of gender-based violence in times of crisis.

The report highlights the following:

1. A need for further **funding on gender and intersectional research** under Horizon Europe, in line with the Gender Equality Strategy 2020-2025 adopted by the European Commission (2020), as well as national funding schemes, to support the monitoring of gendered productivity patterns in research in the recovery phase from the pandemic. Specifically, data collection and research on care responsibilities, gender-based violence, work-life balance and well-being in the R&I sector should be boosted.

2. The necessity of reconsidering the criteria used to assess and select candidates for **recruitment, advancement, and funding**. This may include relying less on bibliometric indicators for recruitment. If used, attention should be paid to gender and intersectional inequalities. Consideration should be given to the impact of the pandemic and lockdown on evaluations and promotions, especially for those with care responsibilities, through corrective measures, prioritising care and sustainability of life over productivity and competitiveness.

3. A demand for **specific research funding schemes for the most disadvantaged groups** (e.g. women, ECRs, researchers with care responsibilities) particularly affected by changing work roles and modes to overcome the productivity decline associated with the COVID-19 pandemic.

4. A call to enhance **international academic and scientific mobility schemes**, including for dual-career couples, by promoting and investing in virtual mobility programmes and providing conditions that allow women and individuals with care responsibility, especially ECRs, to combine care, work and mobility.

5. A request for the availability of **teleworking as a guaranteed option** while designing plans and guidelines for work-life balance and ensuring that the right to disconnect digitally is recognised and regulated.

Overall, this report demonstrates how the COVID-19 pandemic compounded gendered inequalities present before the pandemic. If we want to learn from this experience, adjustments to the R&I system will be needed in the short and medium term in the ways suggested in the **recommendations section per chapter** and tailored to specific stakeholders, in this report.

The Expert Group on the COVID-19 impact on gender equality in R&I was led by:

Prof. dr. Sabine Oertelt-Prigione
Radboud University Medical Center (the Netherlands) and
Bielefeld University (Germany)

Dr. Jens Peter Andersen
Aarhus University (Denmark)

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1. The impact of COVID-19 on academic productivity, practices, and institutional responses

Liisa Husu
Hanken School of Economics (Finland) and
Örebro University (Sweden)

María López Belloso
University of Deusto (Spain)

Flaminio Squazzoni
University of Milan (Italy)

1.1. Overview

1.1.1. Summary

This chapter provides an overview of the gendered impact of the COVID-19 pandemic on academic productivity, as measured by number of publications and changing practices. It considers how academics have adapted to the challenges of the pandemic, as well as the institutional responses at various levels (i.e. institutional support policy and measures at a national, regional and local level).

The pandemic caused an increase in demand for research in various areas, leading to the production of abnormal rates of preprints and more submissions of formal manuscripts compared to previous years. Women researchers benefited significantly less from these changes due to their often less prestigious academic leadership roles, increased care obligations and the support they provided to home-schooling. These trends suggest that these unforeseen opportunities resulted in a publication and citation premium for more prolific academics (mostly men already in academic leadership positions in pre-pandemic times). The cumulative effects coming with the higher recognition of already visible and successful researchers are expected to aggravate the under-recognition of women, gender minorities and underrepresented groups in science. The foreseeable long-term consequences could be increased academic dropout rates and career obstacles for women and underrepresented groups, more significant gender inequities in grant allocation, and a negative impact on women's academic leadership.

The collective response by the academic community to the pandemic challenges implied the development of relatively new means of collaboration and dissemination in COVID-19 research. This put peer review, editorial processes and journals under unprecedented pressure. At the same time, the closure of archives and libraries, the suspension of non-COVID-19-related clinical studies, lab experiments and trials, the freeze on fieldwork in various areas and the diversion of funds to COVID-19-related projects forced entire academic teams and institutions to drastically restructure their research agendas and investments, including either delaying or suspending their activities. These changing practices penalised women and particularly affected groups, such as early-career researchers, individuals with care responsibilities, and researchers experiencing discrimination before the pandemic. There were also positive repercussions: the pandemic increased open science attitudes and practices (e.g. preprints), promoted quick dissemination of findings, and paved the way for more extensive use of online environments and technologies for teaching and meetings. However, **restructuring university services, including the need to adopt new online forms of mentoring and teaching,** meant an extra burden on work-life balance, penalising women and individuals with care responsibilities. These inequalities **constrained the time women allocated to research by imposing a productivity penalty,** thus undermining their career prospects and leadership roles in the recovery period and possibly beyond.

Although online platforms and tools compensated to some extent for the lack of international mobility, and increased diversity and inclusion at conferences and academic meetings, the findings of this study suggest that **women, and especially early-career researchers, missed an opportunity to establish new professional ties instrumental for learning and careers**, which only mobility and in-person interactions can stimulate. These gaps in terms of potential opportunities are hard to assess quantitatively and in the short term. However, surveys have suggested that academics in more vulnerable (e.g. untenured) positions perceived these missed networking opportunities as obstacles to their future career.

By reconstructing the actions and initiatives taken at various levels and by various stakeholders (e.g. national, regional and local), a case can be made that the **gender impacts of the pandemic were largely neglected in these interventions and actions.** Adaptations and responses were mainly left to individuals instead of considering them as complex and gendered organisational processes. While the effects of the pandemic affected certain groups disproportionately, even benefitting some (e.g. men, those in senior positions or working in central and prestigious institutes), research suggests that **institutional responses and interventions were mainly generic**, did not sufficiently reflect context-specific challenges, and often ignored gender and other inequalities in research and innovation.

1.1.2. Framework

This chapter provides an overview of the gendered impact of the COVID-19 pandemic on academic productivity, as measured by number of journal submissions and preprints, practices, including publishing, collaboration, dissemination, networking, and academic careers. It considers how academics

adapted to the pandemic's challenges and the institutional responses at various levels (i.e. institutional support policy and measures at a national, regional and local level). From the beginning of the pandemic in February-March 2020, academic productivity was reported as one of the first signs of a gendered impact of COVID-19 on research and innovation (Breuning et al., 2021). This is addressed in Section 1.2, with a particular focus on preprints and journal submissions. In parallel with unprecedented changes to productivity and publishing, the pandemic caused various academic practices to change. From the first month of the pandemic, there were developments in large-scale scientific collaboration for vaccine research and new means of quick dissemination of findings, with concomitant added pressure on the peer review and editorial processes of journals as well as preprint servers, leading to problems of quality control (Horbach, 2021). The changes were also significant in the new online environments for meetings, teaching and university services, with an unfavourable impact on work-life balance for academic women (Kim and Patterson, 2022). These changes in practices are considered in Section 1.3.

Section 1.4 focuses on academic networking and collaboration. While the race for the vaccine accelerated international collaboration on trials (Krause et al., 2021) and many conferences and meetings shifted to online platforms, there were missed opportunities for mobility and fieldwork, especially for early-career researchers. The difficulty in establishing new ties and the informal collaboration networks vital for innovation and career development significantly affected women and marginalised groups working in less central and well-connected teams and universities.

Section 1.5 concentrates on institutional responses to the pandemic challenges with a gender lens. It considers various types of organisations, including universities and research institutes, research funding organisations, science academies and learned societies.

Finally, Section 1.6 presents specific evidence-based recommendations on all the factors considered previously, with attention paid to different groups of stakeholders, from funding agencies to universities and academic teams.

1.2. The impact of the COVID-19 pandemic on academic productivity

1.2.1. Summary

Although academic productivity is a multi-dimensional concept, given the different missions of higher education institutes (e.g. research, teaching and services), this section considers the impact of the pandemic on academic productivity as *the capacity of academics to deliver research output*, such as papers in the form of preprints or journal submissions. The pandemic led to increasing demand for research in various areas, with abnormal increases in the number of preprints and manuscript submissions compared to previous years. Findings suggest that women benefited significantly less from these opportunities due to holding less prestigious academic positions, and performing more care work and home-schooling.

The abnormal rate of scientific publications fuelled *merit inflation*, i.e. the highest citation rates and more publications in prestigious journals for more prolific academics. These primarily benefitted men who were already senior and in academic leadership positions in pre-pandemic times. These distortions could propagate to the distribution of research funds, affecting reputation, career and research opportunities in the current competitive research and innovation environment. This could increase career obstacles for women, particularly for women of colour or women facing other types of discrimination, leading to potentially higher dropout rates.

To fully capture the systemic interactions of these various pandemic inequalities, research that structurally focuses on gender and intersectionality is needed. The long-term implications of the current practices for the entire academic value chain (e.g. research portfolios, grant proposals, publications, peer review, editorial positions, promotions, awards) need to be explored critically, including in areas (e.g. humanities) less dramatically affected by COVID-19 research opportunities.

1.2.2. Findings

The collective adaptation effort required by the pandemic stimulated the entire publishing ecosystem to streamline the publication cycle, increasing the rapid dissemination of research findings. Journals established **fast tracks for COVID-19-related manuscripts, reduced their turnaround times by 49%** compared to pre-pandemic times, and reduced the time from submission to acceptance from an average of 177 days to 60 days. Traditional publishers removed paywalls, and existing boundaries between preprint archives (e.g. bioRxiv, medRxiv) and journal publications were blurred, creating new opportunities to promote open science practices (Horbach, 2020). However, although public research and higher education institutions adapted their policies to accompany this collective effort, including, e.g. postponing intra-mural funding revisions, dedicated calls for COVID-19-related research, and time extensions for applications, the effects were inequitable. Specifically, the trends described contributed to a widening of gender disparities, especially when combined with the impact of lockdown, restrictions on movement and home-schooling on work-life balance (Ellinas et al., 2022).

From the onset of the pandemic in early 2020, preliminary reports, commentaries and studies suggested that the effect of the pandemic varied greatly between researchers in different disciplines, depending, among other things, on their gender, parenthood, career stage, teaching load, research and methodological expertise, and institutional support (Myers et al., 2020; Vincent-Lamarre, Cassidy, and Larivière, 2020; National Academics of Science, Engineering and Medicine, 2021). Subsequent large-scale empirical studies confirmed these preliminary findings. For instance, a large-scale study on submissions to all journals from Elsevier – one of the largest publishers worldwide – based on a sample of some five million international academics showed that during the first wave of the pandemic, i.e. from February to May 2020, **women submitted proportionally fewer manuscripts than expected from their own pre-pandemic rate of submissions in the same months in 2018 and 2019**. The results showed that this opportunity penalty was stronger for the youngest

cohorts of scholars, e.g. non-tenured researchers in more vulnerable academic positions (Squazzoni et al., 2021) (see Figure 1).

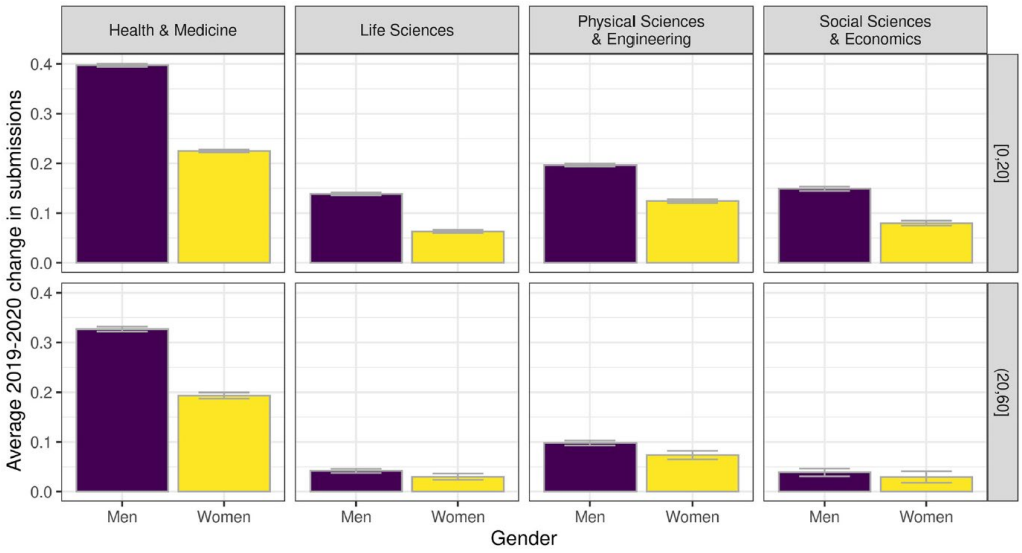

Figure 1. Average change in submissions to Elsevier journals from Feb-May 2019 to Feb-May 2020 by scholar's research area and age, the latter variable including authors in the first cohort (≤ 20 years from their first publication, probably still untenured scientists) with older authors in the second (e.g. associate & full professors). Bars represent standard errors. (Squazzoni et al., 2021)

Another study on the gender distribution of authors in 1 893 COVID-19-related publications estimated that the proportion of COVID-19 papers with a **woman first author in 2020 was 19% lower than that for papers published in the same journals in 2019** (Andersen et al., 2020). A study comparing the gender distribution of first authorships for 42 898 COVID-19-related publications from 1 February 2020 to 31 January 2021 to 483 232 publications from the same journals during the same period the previous year found that the percentage of articles where **men versus women were first authors widened by 14 percentage points during the COVID-19 pandemic**. This was especially striking since many of the research fields investigated displayed near equal proportions of first authorship of men and women before the pandemic (Lerchenmüller et al., 2021).

Using longitudinal publication data on 431 207 authors in four disciplines, i.e. basic medicine, biology, chemistry and clinical medicine, a study published in May 2022 estimated an increase in the average gender difference in publication productivity from -0.26 in 2019 to -0.35 in 2020, with the output of women being 17% lower than the output of men in 2019, and 24% lower in 2020 (Madsen et al., 2022). Overall, these international data demonstrate how the abnormal increase in productivity during the pandemic produced advantages for men and penalised women.

This gendered response of academics to the publication opportunities created by the pandemic was primarily due to competing demands from home-schooling, and care work, which mostly penalised women, and especially academic mothers

from marginalised groups (C. Collins, 2020). These could neither benefit from informal support from grandparents nor from saturated institutional care systems (Blumenthal et al., 2020; Collins, 2020). Furthermore, the higher involvement of women in teaching and management roles in universities and academic institutions imposed further constraints on the allocation of their research time (Minello, Martucci, and Manzo, 2021). Regardless of certain cross-country differences due to variations in the stringency of lockdown measures (Stok et al., 2021), the strategic response of academics to maintaining working routines under increasing institutional pressure mostly resulted in the disruption of family routines due to new forms of division of academic and family labour for which academic women paid the highest price (França et al., 2023). For instance, a study on a large sample of preprints in social sciences estimated that in the ten weeks after the lockdown in the United States, the productivity of female academics dropped 13.2% relative to that of male academics, while the total productivity of academics increased by 35% (Cui, Ding, and Zhu, 2022).

The abnormal rate of academic production and publications, in particular, boosted abnormal citation rates for COVID-19 research. A study published in July 2022 showed that COVID-19-related publications accounted for >30% of citations received in 36 of the 174 disciplines of science and was up to 79.3% in general and internal medicine. For instance, **98 of the 100 most cited papers published in 2020-2021 were COVID-19-related**; 110 scientists received ≥10 000 citations for COVID-19 work, but none received ≥10 000 citations for non-COVID-19 work published in 2020 to 2021. The **prominent role of COVID-19-related research significantly reinforced the advantages of citations and leadership roles** of more established academic teams and institutions (Ioannidis et al., 2022). At the same time, predatory attitudes fuelled by the race for publication and the weakening of peer review and editorial standards due to abnormal volumes of submissions, especially in medical COVID-19-related research, caused an **abnormal rise in fraudulent studies**, including retractions in influential journals (Watson, 2022). One study found that among a sample of manuscripts retracted for fraud or plagiarism, 59% were authored by men, as against 28.6% by women (Decullier and Maisonneuve, 2021). Another study, published in March 2022, on a sample of 80 medical journals found that the review time for COVID-19 manuscripts in 2019 and 2020 was 23 days less than for manuscripts about other topics, with a slightly slower publishing speed for manuscripts with women as first authors (Acciai et al., 2022). This would suggest a possible **trade-off between quick publications on the one hand and peer review and editorial quality standards** on the other, with potentially negative implications for the quality of publications. However, more systematic and large-scale research is needed to understand if gender played an intermediate role between increasing pressures for COVID-19 publication and unethical behaviour.

In line with these quantitative studies, surveys on academic perceptions and prospects confirmed profound gender inequalities in the impact of the pandemic on academic life and productivity. In a survey of 7 670 postdoctoral researchers working in academia worldwide, 61% of the respondents reported that the pandemic had negatively affected their career prospects, and another 25% reported that its cumulative effects on their careers remained uncertain (Woolston, 2020). In a survey on a sample of physicians and non-physician academics at McMaster University in Canada, a higher burnout rate was reported

among women and early-career researchers, with women also reporting more hours of work per day, loneliness, and hours spent on caring for dependents (Garner et al., 2022). A study on a sample of ecologists and evolutionary biologists from various universities in the United States found that women, non-tenured researchers, and those who care for at least one child or teenager, were significantly more dissatisfied with their work-life balance during this pandemic compared to other groups, and expected these negative impacts to persist in the long term (Aubry, Laverty, and Ma, 2021).

1.2.3. Main challenges

The need for a quick response to the public health challenge of the pandemic mobilised the entire academic community and the innovative biotech sectors in COVID-19-related areas, shaping a collective race towards the vaccine (Druedahl, Minssen, and Price, 2021). From the early onset of the pandemic, there was an increase in preprints, journal submissions and publications due to pressing demand and opportunities for research (Aviv-Reuven and Rosenfeld, 2021). This demand either determined unprecedented changes or accelerated existing trends, including a rise in preprints and online repositories, journal editorial fast tracks and many COVID-19-related special issues and commentaries. Over 125 000 COVID-19-related scientific articles were released within 10 months of the first confirmed case, of which more than 30 000 were hosted by preprint servers, which were often immediately discussed by the public (Fraser et al., 2021).

This implied higher opportunities for publication – even in prestigious journals previously largely inaccessible for most researchers – especially for academics who could immediately adapt their research agenda to the demand (Zdravkovic et al., 2020). However, time constraints and a general focus on rapid dissemination of findings may have **exacerbated existing disparities in opportunities, fostering cumulative advantages for mostly men-dominated, already visible and successful researchers and teams**, while further aggravating the under-recognition of women in science; a gender dynamic described as the Matilda effect in the sociology of science (Rossiter, 1993).

1.2.4. Existing policy practices

From early in the onset of the pandemic, the abnormal volumes of research and the priority of rapid dissemination determined new initiatives by various publishers. These measures included the large-scale adoption of open access for COVID-19-related articles in traditionally paywalled journals, as well as options such as fast-track and special issues, and new opportunities for preprint repositories. This increased the public circulation of scientific knowledge and tightened the relationship between academia and the media, but increased the chance that findings still unscreened by peers and journals immediately reached the public (Watson, 2022). A meta-analysis of PubMed data published in November 2022 indicated that among a sample of 19 articles retracted from prestigious journals, there were many observational studies which constituted the predominant type of manuscripts in the early stage of the pandemic (Capodici et al., 2022; Ledford and Van Noorden, 2020). On the one hand, the strong "Covidisation" of research has accelerated dissemination by stimulating new

forms of open science and collaboration among publishers, as well as between journals and preprint repositories. On the other, it has caused distortions and inequalities of opportunities between men and women academics.

To cope with these challenges, important actions, such as **tenure clock extensions for pre-tenured scholars** were put in place by many universities worldwide. Although these actions could work in favour of women and ethnic minorities, in practice **they placed these groups in more vulnerable positions relative to men**, who either continued to work or used their extra time at home more productively than women thanks to a more favourable work-life balance (Smith, Vidler, and Moses, 2022). Examples of these actions assessed in various university settings show that the gendered response of academics also depended on the research intensity of these organisations: in highly-productive research-focused universities, academics – especially women and ethnic minorities – were more likely to prefer tenure clock stops or extensions than in other less research-intense universities. The results show also that most academics generally responded negatively to other stop-the-clock actions subsequently introduced in the same university (Smith, Vidler, and Moses, 2022).

A computer simulation study on the gender ratio of untenured and tenured positions in business schools in the United States of America prior to and after the pandemic estimated that the pandemic would dramatically slow the historical tendencies towards parity even in fields with relatively favourable pre-existing ratios, and regardless of these interventions (Trinh and Van Esch, 2022). This scenario analysis showed poor effectiveness of significant institutional interventions – such as tenure clock extension and support for dependent care – in relieving systemic inequity due to pre-existing cumulative disadvantages, which the effects of the pandemic further exacerbated. The study emphasised that these COVID-19 actions should be accompanied by interventions to increase faculty turnover and early retirement plans, which more often affect men due to current gender representation in academia. More detail on the institutional responses is reported in Section 1.5.

1.3. Changing academic practices in turbulent times

1.3.1. Summary

The pandemic caused a dramatic change in various well-established practices in many areas of academic life and research, including a recalibration of the meaning of gender equality in the private, professional and public spheres, especially at the intersection of family, society and academia (Remery et al., 2022). Many well-established academic practices were affected, including fieldwork, data collection and laboratory and library access, as well as the re-direction of intra-mural funds to COVID-19-related studies, not to mention the demand to shift conferences, meetings and lectures online, which revealed pre-existing inequalities and gaps at various levels (e.g. in national tech infrastructures, local university facilities). While some academics – especially those with stronger institutional support – were able to adapt their research projects, methods, data collection, teaching and supervising duties to the online environments (Kobakhidze et al., 2021), most suffered from **delayed experiments, suspended fieldwork and data collection**, not to mention

unfavourable working environments in terms of **poor technology** and **lack of appropriate office-like set-ups** at home. Many early-career researchers were also penalised by weakened mentoring and institutional support (as reported in Chapter 2).

On the one hand, the **pandemic increased positive open science attitudes** and practices (e.g. preprints, data sharing) and paved the way for more extensive use of online environments and technologies for teaching, meetings and university services. On the other, the **restructuring of university services**, including the need for new online forms of mentoring and teaching, which were more **time-consuming and demanded extra training and resources, had a clear gender dimension**. The restructuring implied an extra burden for work-life balance, penalising women who are more involved in academic housework as well as domestic housework, especially mothers and those with care responsibilities.

1.3.2. Findings

According to data provided by UNESCO in April 2020, schools were closed in 185 countries, affecting more than 1.5 million students. The duration of the closure varied from country to country but according to the same UNESCO report, in May of the same year there were still 1 200 000 students affected by the closure (UNESCO, 2021). According to an International Association of Universities (IAU) report, 98% of higher education institutions (HEIs) reported that teaching and learning had been affected by the pandemic and most of their activities had been moved online (Marinoni, van't Land, and Jensen, 2020). Although with certain regional differences (e.g. Africa in 2020 already had the highest rate of activity cessation due to lack of infrastructure; see UNESCO, 2021), **85% of higher education institutions in Europe moved to e-learning**, while 12 % of higher education institutions were developing solutions (Gatti et al., 2020; Marinoni, van't Land, and Jensen, 2020).These structural adaptations of the educational sector deeply affected the working conditions of academics worldwide.

A study of a sample of 5 920 Dutch academics surveyed from August to September 2020 found that academics had to re-structure their academic life and their allocation of time between teaching and research, not to mention the work-life balance. For instance, 40% of all academics reported a loss of research time. **Of academics with children at home, 51% reported that the pandemic decreased their research time**, compared to 32% of academics without children. Moreover, the reported loss was twice as large as that of academics without children in their household (Royal Netherlands Academy of Arts and Sciences, 2022).

Two surveys of principal investigators (PIs) conducted between April 2020 and January 2021 with a random sample of US and Europe-based academics revealed that while COVID-19's initial impacts on scientists' research time seemed to have been alleviated, there had been a decline in the rate of initiating new projects. This disproportionately affected women, and those with young children, regardless of their research area (Gao et al., 2021). This is confirmed by a study on a sample of tenure-track faculty in the hard sciences, working in 20 randomly selected research institutes in the USA with two surveys, administered in May

2020 and May 2021 respectively. The results showed a significantly greater negative impact of the pandemic on women's research activities and work-life balance compared to men (Caldarulo et al., 2022). A survey published in April 2022 featuring a sample of Australian authors selected from the PubMed database showed that most researchers expressed concerns about sharing career disruption information in job or funding applications, with the view that it would harm their chances of being funded. Not only did women suffer a more severe impact from the pandemic: they might later be penalised by the perceived stigma for reporting career disruption, as well as the inadequacy of the system to foster transparency, probably due to the competitive research culture (Barnett et al., 2022). In March 2020, academic research laboratories across the world shut down due to anti-contagion lockdown measures. A study reporting on lab re-opening in the United States, with in-depth interviews with biomedical research trainees conducted between September 2020 and March 2021, found significant inequities in access to sufficient lab time, increased stress around productivity, and frustrations with the culture of academic science (Jeske, 2022). Many of these inequities were reported more often by women academics.

The adaptation to the online environment required a significant effort by university faculty and staff (European Commission, Directorate General Education, Youth, Sports and Culture et al., 2021). Shortcomings and difficulties experienced by the university teaching staff were mostly due to a lack of preparedness for the use of digital technologies and lack of adequate methodologies to transform traditional education into online education (European Commission, Directorate General Education, Youth, Sports and Culture et al., 2021; Marinoni, van't Land, and Jensen, 2020; Pellegrini, Uskov, and Casalino, 2020). This especially affected disciplines deprived of key teaching infrastructures, such as laboratories, or access to patients (Marinoni, van't Land, and Jensen, 2020). However, surveys, such as one performed by the Horizon 2020 funded SUPERA project, showed that the readiness for the transition among the teaching staff was gendered, with a **higher proportion of women lacking ICT training**, and was also affected by other factors, such as age or disability (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021; Ilić-Kosanović, 2021). Age has also affected the productivity of female academics in relation to their career status. Several studies have pointed out that the researchers who most frequently reported a decline in productivity were early-career researchers in areas such as economics (Amano-Patino et al., 2020), medicine (Andersen et al., 2020), and the social sciences (Cui, Ding, and Zhu, 2022). In terms of the impact on racialised women, the expectations and stereotypes that accompany this group of female academics, known as the "mammy professorhood" (Docka-Filipek and Stone, 2021), translated into a **greater burden of attention to students, and care and service in the institutions**, seriously affecting their productivity (Staniscuaski et al., 2021).

According to the European Commission's report on the impact of COVID-19 on education (European Commission, Directorate General Education, Youth, Sports and Culture et al., 2021), teaching in pandemic times was mostly emergency distance learning, including live-streamed lectures, teaching staff sending their presentations to students, asynchronous pre-recorded lectures available online, and asynchronous audio-only recorded lectures (European Commission, Directorate General Education, Youth, Sports and Culture et al., 2021), rather

than pedagogically well-designed online learning, as neither the curricula nor the methodology were adapted. As suggested by Pellegrini et al. (Pellegrini, Uskov, and Casalino, 2020), the capacity of universities and academic institutes to deliver high-quality learning opportunities was penalised by time allocation constraints, lack of training on methodological innovations, lack of infrastructures and weak regulation and assessment. Given the effort and work-life adaptations provided by academics and the **gender inequality in teaching and administrative load**, it is reasonable to assume that the extra cost and inefficiencies of this important transition towards online teaching and learning were mostly borne by women (Peña et al., 2022). This study on the impact of COVID-19 in a Spanish University of Technology showed that more **women spent more than 50% additional time on e-teaching compared to face-to-face teaching than men** (83.8% of women vs 76.3% of men) (Peña et al., 2022). This increased workload was also associated with other tasks, such as the hours spent on student email inquiries during the period of virtual teaching. Over half (55.3%) of women reported that the number of inquiries had increased by between 50% and 100% (41.5%) or by even more than 100% (13.8%). More men reported very high increases (22.0% reported more than 100% increases) but only 24.6% reported increases between 50 and 100% (46.6% combined). 19.4% of men reported no increase, while only 14.6% of women did so.

Besides an unfavourable work-life balance for academic women, especially mothers of young children (Ashencaen Crabtree, Esteves, and Hemingway, 2021; Augustus, 2021; Górska et al., 2021), research has also shown that **the quality of teaching was affected by isolation, lack of contacts and exchange, including higher levels of technostress due to lockdown at home, with significant gender effects** (Peña et al., 2022; Penado Abilleira et al., 2021; Susilaningsih et al., 2021). Women researchers were penalised the most, as they undertake the majority of teaching and student support tasks (Ashencaen Crabtree, Esteves, and Hemingway, 2021). Research has also indicated that academic housework and caring for students fell more on female faculty, 85% of whom reported having had one-on-one video, email or phone conversations with students about mental health, compared with 71% of male faculty (Lipson et al., 2021). A report on a Dutch sample of academics indicated that 61.9% of respondents found supervising and relationships with students more challenging than before the pandemic (Royal Netherlands Academy of Arts and Sciences, 2022).

Finally, research has found that the **evaluation of online teaching was gender-biased**, with potentially negative implications for women's career progression in the long term (Ayllón, 2022; Renström, Gustafsson Sendén, and Lindqvist, 2021; Tangalakis et al., 2022). A study on online teaching and gender bias (Ayllón, 2022) showed that evaluation gender bias was present whenever students evaluated a teacher's overall performance rather than certain specific dimensions, such as the course syllabus, the evaluation criteria, the quality of the support materials or the evaluation procedure. The study suggested that, as neither lecturer performance and effectiveness, nor student sorting can explain these outcomes, this impact on women academics' performance revealed a gender bias (Ayllón, 2022). Inequalities not only affected the distribution of academic tasks, but also evaluation. Student evaluations of remote teaching in Australia found that female teachers were 50% more likely to receive negative

feedback based on their teaching style than male teachers (Tangalakis et al., 2022).

1.3.3. Main challenges

The effect of COVID-19 has been reflected in the re-shaping of existing academic practices by either imposing new standards or speeding up existing trends. The pandemic saw the emergence of increased use of preprint servers for research dissemination and an increasing demand for open science practices, including data and code sharing, and tighter connections between research and public information (van Schalkwyk and Dudek, 2022). While evidence suggests that quick dissemination of findings (either in preprints or fast-tracked articles) and open access of journal articles do not necessarily translate into the highest standards of research and replicability (Collins and Alexander, 2022), these practices have changed the ecosystem around scientific publications, probably strengthening the leadership position of those established academic teams and senior academics who were capable of adapting promptly to these opportunities. Although research on gendered patterns of open science attitudes and practices is still scarce, preliminary results have shown that **more vulnerable academic groups would still be less advantaged by open science practices due to a lack of familiarity with these new standards and the weakest institutional support for full compliance** (Vuong et al., 2021).

Furthermore, in pandemic times, with rapid science in high demand, academic productivity was also affected by online environments and the multiple services assured by academics, such as online lecturing and student tutoring (King and Frederickson, 2021). Indeed, the pandemic resulted in inequalities in the inner working of two important functions of universities and institutes: service and teaching. Universities and research institutes reacted to the pandemic challenges by **increasing the administrative burden on their academic staff and over-exploiting internal university services**, where women academics are on the frontline. Given women's already greater teaching duties in often relatively unfamiliar e-teaching environments while many of them had more home and care duties (Malisch et al., 2020) this could partially explain the productivity gap compared to men outlined in Section 1.2.

1.3.4. Existing policy practices

Although institutions at various levels tried to support the shift of many academic activities online – including administrative meetings, student supervision and teaching – inequalities in support, heterogeneous levels of technology infrastructure, and an unfavourable work-life balance mostly penalised women. A noteworthy positive example was a Spanish national initiative, the *Conectad@s: La Universidad en Casa*, promoted by the Conferencia de Rectores de las Universidades Españoles (CRUE) and the Ministry of Universities in Spain, in collaboration with the Universidad Nacional de Educación a Distancia and the Universidad Abierta de Cataluña. This collaboration enabled the establishment of a digital platform with resources for non-classroom learning and guidelines and content to support teachers in the migration from face-to-face to online training.

1.4. Academic networking

1.4.1. Summary

The pandemic caused an abrupt collapse in academic international mobility for an extensive period, which dramatically affected academic networking. Although the dissemination of online platforms and tools compensated to some extent for the lack of international mobility, increasing diversity and inclusion, especially at conferences and academic training meetings, nevertheless women, untenured, early-career researchers and marginalised groups in academia missed the opportunity to establish new professional ties instrumental for learning and careers. These gaps in terms of potential opportunities are hard to assess quantitatively and in the short term. Yet, surveys have suggested that academics perceived these missed networking opportunities as obstacles to their future career.

1.4.2. Findings

A study on the email network of the MIT campus in the USA found that lack of researcher co-location during the COVID-19 lockdown caused the loss of more than 4 800 **weak ties – ties between distant parts of the academic system that enable the flow of novel information**. The reintroduction of partial co-location through a hybrid work mode led to only a partial regeneration of weak ties (Carmody et al., 2022). While it was possible to maintain existing strong ties between academics relatively easily via online environments (e.g. existing long-standing inter-group collaborations and intra-group joint projects), the type of ties that suffered the most from the lack of mobility were potential new ties which were never formed or those weak ties which were not sufficiently consolidated to provide relevant information.

A study on a larger sample of academics from bioRxiv preprints published in July 2022 showed that, although COVID-19 had a positive effect on national collaboration (both intra- and extramural), probably either building on or exploiting existing ties, international collaborations collapsed, although with context-specific trends (Abramo, D'Angelo, and Di Costa, 2022). To anticipate resource constraints or maximise expected future returns, academics either cancelled potential projects or gave priority to COVID-19-related projects involving existing long-standing ties (Brainard, 2022). The rare examples of research examining the effect of the reduced networking during COVID-19 found that the most negative effect was on early-career researchers, women and minorities, including especially as a result of the suspension of mentored research training and lack of opportunities for informal communication, and that the long-term implications on academic drop-out and career development were difficult to estimate (McCormack et al., 2020; van Tienoven et al., 2022). Although there were certain obstacles to international mobility and networking of women even before COVID-19 – including family arrangements, weaker mentor support, and access to networks – it is reasonable to expect that women, especially early-career researchers, were penalised the most from the diminution of academic weak tie networks (Minello, 2020).

1.4.3. Main challenges

It has been estimated that academics travelled more than 150 000 kilometres per year before the pandemic for conferences, meetings and lectures (Jack and Glover, 2021). **COVID-19 forced many conferences and academic events to transition online, often increasing participation, inclusion and diversity**. However, **establishing new academic ties, communication networks and informal collaborations via co-location and mobility was interrupted**. Rewiring ties in communication networks is vital for innovation and academic collaboration.

Previous research has shown that weak ties – ties of an academic with distant networks and institutional groups – are critical for job mobility and careers, giving a chance to marginalised or individuals working in peripheral universities especially to learn from and collaborate with more prestigious networks and teams (Zubieta, 2009). This also applies to women's ability to expand their network of connections, thus increasing access to opportunities, resources and job positions in relatively unfavourable environments (Crowell, 2004). Previous research has documented extensively that women are less frequently in central network positions than men, even when working within the same university, and that women's academic networks, e.g. co-authorship networks, tend to be smaller and less connected (Akbaritabar and Squazzoni, 2021).

1.4.4. Existing policy practices

A recent study on social networks and loneliness during the COVID-19 pandemic, which used longitudinal social network data collected in 2019 and 2020 from a sample of respondents at Yale University, found that the size and density of individuals' personal networks decreased significantly following periods of social isolation (Kovacs et al., 2021). Their findings incited organisations to focus on reconnections, e.g. **regenerating lost relationships**. Although some initiatives were taken to increase the conviviality of innovative environments for social reconnections (see Box 1), including the establishment of **informal settings for virtual coffee breaks** in online events (Bastian et al., 2022), attending large-scale online events, especially from various time zones, cannot fully repair these lost connections.

Box 1. Social reconnecting during lockdowns

Brendan O'Riordan, Director of Business Intelligence at Suffolk Construction in Boston, USA, began setting aside 30 minutes each week to have virtual coffee and casual conversations with colleagues. "The response has been overwhelming," he said. He has "never had one cancelled. Never had someone say, no I'm too busy. Usually, you get an email back within half an hour with an invite saying: Let's do that" (King and Kovács, 2021)

1.5. Institutional responses from a gender perspective

1.5.1. Summary

The impact of COVID-19 has incorporated various institutional responses, including some gender-related responses from various organisations, including universities and research institutes, research funding organisations, science academies, learned societies and trade unions. However, **most institutional responses have been gender-blind**: persistent gender inequalities that have been robustly demonstrated in academia have often been overlooked and rarely considered. Among the responses with a gender perspective, some have focused only or mainly on science, technology, engineering and mathematics, and medical fields, even though researchers in all fields have been impacted, and some responses have focused primarily on women researchers or academics rather than gender equality in research more broadly. Intersectional aspects have also been considered in several responses addressing gender impacts, especially in Australia and USA. Most studies and reports approached the gendered impact of COVID-19 by underlining existing inequalities and a lack of diversity in academia and research that existed even before COVID-19.

1.5.2. Findings

The relevance of institutional responses in assessing the impact of COVID-19 from an individual researcher's perspective was highlighted by an online survey about the impact of COVID-19 on academics' personal lives, well-being and health in a convenience sample of 1 099 academics working in various research intensive-universities the UK (Watermeyer et al., 2021). The results showed that academics tended to emphasise the importance of universities' institutional responses and the responses of senior leaders to COVID-19 rather than the direct impact of the pandemic itself. This study showed that the impact of COVID-19 was considered transformational and primarily negative. As a teacher respondent (in legal and management studies) put it: *"The COVID crisis itself is not the problem. The problem is the responses to the crisis that have exacerbated inequalities."* (Watermeyer et al., 2021, p.653).

The survey identified a process of centralising decision-making to leadership teams during COVID-19, unilateral decision-making without consultation, and weakening the professional autonomy of academics (Watermeyer et al., 2021). An overwhelming majority (91%) of respondents stated that the organisational response of universities to COVID-19 and the combination of work-intensification and cost-cutting had extended existing work-based inequalities in universities; 67% felt that the crisis had been used as a *foil* for exploitative practices (Watermeyer et al., 2021, p.657). The respondents identified a de-prioritisation of research and reprioritisation of teaching: **75% said COVID-19 had been detrimental to their research, including cancellation of research**, research awards and even advertised positions.

Respondents voiced emerging concerns that it was the careers of women academics that were being most disadvantaged by the effect of the pandemic. Some respondents advocated positive discrimination in the redistribution of funds

according to gender, which was seen as necessary in maintaining the commitment to equality and diversity.

A long-term negative gender impact was forecast. A professor in STEM argued:

> *Unless there is a very significant reallocation of funding to the research conducted by women and a mandate to assign women as PIs on major research projects, the university research sector will lose more than a decade of its advancement in key areas and lose traction and relevance to society as a whole (Watermeyer et al., 2021, pp.658–659).*

More generally, an overwhelming majority of respondents (92%) expected a long-lasting impact from the universities' responses on academics' work, health and well-being.

Despite the importance of gender equality plans at European universities, which are supported by European Research Area (ERA) policy priorities, the evidence indicates decreased engagement with gender equality promotion, even in contexts with a strong national emphasis and remit on gender equality, such as Sweden. All Swedish universities have a gender mainstreaming duty from the government and their gender mainstreaming activities are annually monitored by the Swedish Gender Equality Agency (JÄMY). The monitoring of activities in Swedish universities in 2020 demonstrated a **decline in gender mainstreaming activities in universities**, fewer resources being allocated, cancellations of gender equality/gender mainstreaming conferences, events and training, when universities prioritised transition to online teaching and research. Universities' gender equality practitioners reported difficulties in engaging the university community around gender equality and diversity when activities could take place in virtual environments only. The situation improved to some extent in 2021 with increased gender mainstreaming activity levels (JÄMY - Swedish Gender Equality Agency, 2021, 2022).

A study of UK Business Schools during COVID-19 found that the response of these schools to COVID-19 applied a non-gendered perspective, despite them being involved in the ambitious Athena Swan gender equality accreditation programme at the time. Hard data on the potential gendered impact of COVID-19 was not collected within these Business Schools and thus potential gendered impacts remained unidentified and invisible (Aguiar, Haque, and Bender, 2022).

The Norwegian Association of Researchers (Forskerforbundet) mapped the experiences of the impact of COVID-19 among its members in a survey in October-November 2020, including their views on institutional support (N=4 833, response rate 49%) (Norwegian Association of Researchers, 2021). Overall, more than half of the respondents were dissatisfied with the support obtained from their university for their research and development activities, with women being clearly more dissatisfied than men. The results indicated large variations across Norwegian universities in how positively institutional responses were assessed by academics (Norwegian Association of Researchers, 2021, p.31). In Australia, where universities rapidly moved to online teaching and work at the onset of COVID-19, two sector-wide studies on universities' COVID-19 responses explicitly

considered a gender angle (Nash and Churchill, 2020; Sutherland et al., 2022). Desk research analysing 41 Australian universities' publicly available policies, with a focus on remote working and care, indicated that, rather than approaching these issues as institutional concerns, the universities addressed the issue of care leave and participation in the labour force mainly as private concerns for which individuals, mainly women, were expected to design a solution (Nash and Churchill, 2020).

By comparing the Australian responses to ten world-leading universities in the UK and the US (including many Ivy League universities), the report suggested that the latter offered more flexible arrangements with leave than universities in Australia. Eight out of ten of the top universities addressed the issue of caring while working from home/remote working in their documents. Half of the top universities offered specific COVID-19-related leave. Even if personal leave was offered in these top universities as the primary solution to respond to caring responsibilities during COVID-19, the use of the COVID-19-related specific leave could be used flexibly and not only after exhausting other personal leave opportunities. In addition, most of the top universities in the US offered information about emergency care arrangements (called "crisis care" or "backup care"). This kind of care was offered to staff who could not use their regular childcare or elderly care arrangements during COVID-19.

Another gender impact analysis of Australian universities' early responses to COVID-19 covering five key policy domains (i.e. support for higher degree research students; leave arrangements for staff; remote working; managing staff; and academic promotion), indicated that the least attention was given to managing/supervising staff and academic promotion (Sutherland et al., 2022). Of the 40 Australian universities, 23 offered support for higher degree research students, but this was mainly in the form of information and advice rather than formal policy changes or mechanisms beyond already available existing options. No university explicitly considered or addressed gender impacts. No attempt was made to address the dual role of women as parent/carer and PhD candidate, a situation that is more challenging for women PhD candidates due to the gendered division of care. The study suggested that universities' leave policies during COVID-19 remained relatively unchanged and that most policies related to leave arrangements did not sufficiently consider how gendered roles and responsibilities might affect the need for leave during COVID-19. The same applied to remote working, where only generic and often informal advice was offered. For instance, in one of these Australian universities, some advice was found that even suggested: *"those most impacted were probably not involved in its development"*. For instance, the guidelines from one university included this sentence:

> *Try to ensure you can focus. Noise, televisions, or even pets can cause you to lose focus. Set ground rules with other people in your home or who share your space for when you work. If you have children who come home from school while you're still working, try to plan out your day and theirs. They need clear rules about what they can and cannot do during the time you are working. (University #29 in Sutherland et al., 2021)*

The increased risk of family violence during COVID-19 was taken up only by two universities.

When it came to guidance for managers, many universities encouraged supervisors and line managers to facilitate flexible work options but with little substance beyond empathy and goodwill. If more tangible advice was provided, this generally focused on alternate tasks, changing working hours, working days or work patterns, but with no advice on how gender might influence the employees' experiences of COVID-19. No universities were found to offer formal flexible policies in response to COVID-19 or additional training for line managers or supervisors around advocating or promoting flexible work arrangements. Furthermore, **the need for flexibility in response to COVID-19 was found to be frequently framed as an individual rather than an organisational or structural problem**, and supervisors and line managers were positioned as gatekeepers to the arrangements. Finally, when it came to academic promotion, only six Australian universities offered information, which was mainly administrative, on changes of deadlines or cancellations of promotions, but none acknowledged additional barriers women might face in promotions due to COVID-19 (Sutherland et al., 2022). Overall, few policies were found to address differential gendered impacts related to traditional gendered care responsibilities, thus disregarding the need to create policies concerning reduced productivity and career disruption.

An early review of policies by major funding agencies, including Horizon 2020 (the predecessor of Horizon Europe), the German Research Foundation (DFG), and the French National Agency for Research (ANR), found that their typical responses were: increased flexibility in the application and execution of projects, extending call deadlines, non-cost-extending project time, delaying the start of a project, costed extensions for doctoral students whose work had been interrupted by COVID-19, extra funding for projects in certain circumstances, allowing relocation of funding, the possibility of reorienting research projects and launching calls for COVID-19-related research (Stoye, 2020). Two years into COVID-19 many of these responses were still relevant: for example, for European Research Council (ERC) ongoing grants, requesting a six-month extension was still possible in 2022, subject to case-by-case assessment. There was also flexibility in terms of personnel costs, in particular teleworking costs (European Research Council, 2022).

1.5.3. Main challenges

One of the main challenges in institutional responses was in **applying a generic non-gendered approach, while ignoring existing, well documented inequalities in academia and research**, and how COVID-19 might exacerbate these inequalities. An example of such an approach is the response of the leading European universities, the League of European Research Universities (LERU). In May 2021, one year into COVID-19, LERU Rectors launched a Statement on the role of academic institutions in building resilient and sustainable societies, by referring to the UN Sustainable Development Goals (one of which is gender equality) (LERU Rector's Assembly, 2021). While the statement addressed many university governance principles and goals, and took up many issues such as

teaching, careers and academic excellence, which are highly gender-relevant, the challenge of addressing gender inequalities was not even mentioned.

The non-gendered approach of the institutional responses can also concern the groups and individuals who are responsible for designing, implementing, and monitoring the responses. There is evidence that women and vulnerable groups, such as early-career researchers, are not adequately represented and consulted in these processes (e.g. National Academics of Science, Engineering and Medicine, 2021; Sutherland et al., 2022; Watermeyer et al., 2021)

COVID-19 was a major challenge for research funding organisations, disrupting application and review processes, as well as ongoing and contracted research, and creating pressures for a redirection of research focus. During the first year of the COVID-19 pandemic major research funders in Europe, the US and Australia among others, adapted their funding policies in various ways to respond to COVID-19, mainly increasing flexibility in the funding process. Increased flexibility can also include challenges, if, for example, an extension of project running time is granted but as a non-cost measure, without additional funding that would cover the salaries of researchers and trainees for the time they were not able to conduct research (see National Academics of Science, Engineering and Medicine, 2021, p.55). A thorough analysis of the gender impact of funders' responses still needs to be conducted, but the existing data suggests that **gender perspectives were rarely taken into account in these responses**, with some interesting exceptions (see Section 1.5.4.)

A major challenge concerns the long-term gender impact of COVID-19 on recruitment and career advancement from an institutional perspective. What kind of practices have universities, research organisations and funding organisations adopted to consider the impact of COVID-19 on research productivity when making recruitment, retention, and funding decisions? How can these practices be implemented in a way that is gender-sensitive but does not additionally punish women researchers?

1.5.4. Existing policy practices

National authorities: The HEA National Committee for Gender Equality in Ireland, which comprises the Higher Education Authority (HEA), the Irish Universities Association (IUA) and the Technological Higher Education Association (THEA), as well as the Vice-President/Directors of Equality, Diversity and Inclusion representatives from HEIs, issued a statement on the COVID-19 pandemic and gender equality in Irish higher education in June 2020, acknowledging the risks of set-backs for women academic's career progression, and providing a list of good practices for Irish HEIs to mitigate this impact. However, specific research on the effect of the pandemic on gender equality in Irish higher education is not available (HEA National Committee for Gender Equality in Ireland, 2020).

Science Academies: One of the key science stakeholders in the US, the National Academy of Science, Engineering and Medicine (NASEM) commissioned an extensive report on the first ten months of COVID-19 (from March to December 2020) to assess the effect of specific interventions on women and evaluate the

early indicators of impacts on the career trajectories of women in the science, technology, engineering and medicine sector (National Academics of Science, Engineering and Medicine, 2021). The NASEM report addressed five key areas: career trajectories, work-life integration, collaboration and networking, leadership and decision-making, and mental health and well-being, and considered the impact on women of colour as a cross-cutting issue. While the findings confirmed various sources of inequities caused by COVID-19, including the productivity gap, the report found that decisions and actions on institutional support, such as work-from-home provisions and extensions on evaluations, did not contribute to ameliorating the underlying gender-based inequalities in academic advancement and were less gender-neutral than assumed. This was because extensions did not necessarily match the needs of women researchers with different caregiving challenges, women not on the tenure track, and women with multiple marginalised identities. The findings suggested that individual coping strategies were not sufficient, especially because of the pre-existing gendered division of labour and called for organisational-level approaches. Even the positive effects of online tools and virtual platforms for conferences and meetings in terms of lower attendance costs and inclusion often backfired due to a demand for over-flexibility and opportunities for bias in virtual platforms. Bias in virtual platforms can include getting talked over, interrupted, being ignored more frequently than in meetings in person, as was evidenced by a Society of Women Engineers (SWE) membership survey in 2020, in which nearly a third of respondents reported such an experience, the younger age groups more frequently (Ringon and Nguyen, 2020). Furthermore, the report suggested that decision-making processes related to COVID-19 responses, including financial decisions, lay-offs and furloughs, often immediately implemented beyond pre-existing practices of academic governance, tended to discriminate especially against women and people of colour with contingent and non-tenured positions, with potential long-term effects.

In a high-level regional stakeholder collaboration, the Australian Academy of Science published a report on the impact of COVID-19 on women in the STEM workforce in the Asia-Pacific regions, with a survey conducted in March-April 2021 including a region-wide sample from 31 Asia-Pacific countries (N=1 109, of which 865 women) (Australian Academy of Science, 2021). The findings showed that almost half the women with caring responsibilities did not have access to flexible work, despite 60% of them viewing flexible arrangements as better support for their working conditions.

Funding organisations: Some research funding organisations considered a gender perspective in their responses to COVID-19. For instance, the Canadian Institutes of Health Research (CIHR) introduced gender policies in their funding process after launching a rapid response COVID-19 funding competition in February 2020 (Witteman, Haverfield, and Tannenbaum, 2021). Initially, the CIHR observed that women applied less to this call, were less successful compared to previous calls from the same agency and that only a small proportion of applications included a gender or sex dimension in their proposals. In a subsequent funding competition in April-May 2020, the CIHR introduced several data-driven gender equality interventions to address the gender imbalance, including an extension of application time and allowing shorter bio-sketches instead of the standard long CVs. Furthermore, as measures to increase research

quality by integrating gender aspects, the CIHR published guidance on how to include sex and gender in research content in COVID-19 research and required reviewers to evaluate the integration of sex, gender and other identity categories in all stages of the research process. Additional measures included compensation for caregiver costs, extending early-career status, doubling parental leave credits and allowing applicants to submit an optional COVID-19 impact statement with the grant application. The results showed a higher percentage of success by female applications (see Box 2 and Table 1). A related European ad-hoc case study also addressed sex/gender in COVID-19 research (European Commission, Directorate General Research and Innovation, 2020).

Box 2. Results of the CIHR study into increasing share of female applicants for COVID-19 grants.

The Canadian Institutes of Health Research (CIHR) integrated gender aspects after launching a rapid response COVID-19 funding competition in February 2020. By factoring sex and gender into grant requirements between the first and the second competition, applications from women increased from 29% to 39%, and the share of female PIs in funded applications doubled from 22% to 45% (see Table 1). Unlike in the initial competition, in the second one, more applications integrating sex and gender dimensions in their research proposal were funded. The CIHR concluded that pandemic responses must consider data-driven gender equality interventions and adopt gender-sensitive programming.

Table 1. Female application pressure and success rates before and after CIHR gender policy changes (source: Witteman et al. (2021)).

	Proportion of total applications submitted, %		Proportion of applications funded, %	
	Female PI	Male PI	Female PI	Male PI
Investigator-initiated open competition	36 (*n* = 790)	64 (*n* = 1392)	40 (*n* = 154)	60 (*n* = 231)
First COVID-19 competition	29 (*n* = 65)	70 (*n* = 159)	22 (*n* = 22)	76 (*n* = 76)
Second COVID-19 competition	39 (*n* = 586)	60 (*n* = 898)	45 (*n* = 62)	55 (*n* = 77)

Percentages do not always add up to 100, as ≤2% of applicants for each competition did not provide any entry in the female/male field.

Trade Unions: Norwegian researchers' union, Forskerforbundet, mapped the experiences of the impact of COVID-19 among its members in a survey in October-November 2020 (N=4 833, response rate 49%) (Norwegian Association of Researchers, 2021). The responses were presented by age group, gender, academic position, and by university. Overall, more than half the respondents were dissatisfied with the support of their university to their research and development activities, women clearly more so than men. There were also large variations across Norwegian universities in how positively institutional responses were assessed by academics as well (Norwegian Association of Researchers, 2021, p.31).

1.6. Recommendations

The COVID-19 pandemic put research and innovation on the frontline of the collective response to the global health challenge worldwide. It favoured immediate large-scale collaboration and data sharing, strengthened the adoption of open science practices, promoted quick dissemination of findings to produce innovative science-driven technologies and improved the adoption of innovative online technologies for networking, training and learning. The effects on gender equality and diversity in academia and science were many. Extant research and data had already demonstrated long-standing gender inequalities and lack of diversity in academic organisations and careers before the COVID-19 pandemic. However, the effects of COVID-19 have further exacerbated gendered inequalities by affecting academic reputation, prestige, and power relations while putting the youngest and untenured scholars under severe pressure amidst unpredictable future career prospects. COVID-19 aggravated existing gender, generational and intersectional inequalities in many ways, but the institutional responses rarely considered or addressed these inequalities. There is a risk of a setback to gender equality and diversity achievements as a long-term impact of COVID-19. Immediate, targeted action and collaboration across stakeholders, from the European Union and national decision makers to various academic institutions, and funding organisations, are required to mitigate these risks.

For 1.2 (productivity gap), we recommend that:

the European Commission and (regional or national) funding agencies in general:

- Build on the work of the Coalition for Advancing Research Assessment (CoARA) and the ERA Policy Agenda Action 3, to **endorse multi-dimensional measures of academic productivity** in the assessment of funding proposals (e.g. in Horizon Europe), and weight possible merit inflation due to COVID-19 opportunities;

- **Offer applicants the possibility to report on their COVID-19 experience and potentially-related career gaps** by promoting evaluation procedures that consider these cases, possibly anonymously to avoid any expected stigma.

Research teams:

- **Study multi-dimensional measures of academic productivity** that more adequately and comprehensively reflect the complexity of scientific output across multiple activities (research, teaching, academic care, service), considering context-specific factors and using various approaches and methods;

- Favour research on academic productivity that uses the best available digital data to control for confounders and **compare academic samples of various institutional and organisational contexts,** possibly with both qualitative and quantitative approaches.

For 1.3 (changing practices), we recommend that:

the European Commission and (regional or national) funding agencies in general:

- Ensure that **science practices and priorities consider gender and intersectional perspectives** to avoid exclusion and penalties for academics and teams from less prominent institutions in standards and compliance;

- Increase funding for **the establishment and maintenance of networking and mentoring schemes,** dedicated specifically to women, to enhance their career development in an inclusive manner.

Universities and research-performing organisations:

- Ensure a **gender balance in administration, supervision and mentoring programmes** to avoid reproducing a gendered productivity gap;

- Support either faculty governing bodies or designated faculty members/ad hoc bodies to ensure the **implementation of equality metrics and policies, which address the COVID-19 impact** at their institutions, and provide dedicated resources where needed. If ad hoc bodies/committees are created, these should be diverse, include gender experts, be trained on gender equality (particularly gender biases) and knowledgeable about institutional equality policies.

For 1.4 (academic networking), we recommend that:

Scientific associations, funding agencies, and research performing organisations:

- **Develop guidelines, involve stakeholders and overview the best practices of hybrid meetings in various contexts** to promote inclusion, address bias, fully respect work life-balance and minimise existing infrastructure gaps;

- **Support event attendance of most vulnerable groups** by covering various care costs, including child, disability and elderly care to **avoid a two-tier international mobility system** with physically present scholars who benefit greatly from informal, in-person networking and more vulnerable groups, women and minorities only connected online and excluded from similar benefits;

- **Allocate specific budgets for mobility and networking** to establish weak ties and professional bonds, especially addressed to women and more vulnerable groups.

For 1.5 (institutional responses), we recommend that:

the European Commission:

- **Increase funding for research on gender and intersectional inequalities in R&I** based on mixed-method approaches, stakeholder

involvement, and organisational and institutional analysis to improve our understanding of the multi-layered pandemic impact and increase the resilience of the R&I community to global shocks.

- Consider the COVID-19 impact on gender and intersectional inequalities in R&I, in **policy dialogues with the ERA Action 5 subgroup** ('Inclusive Gender Equality in the ERA'), particularly regarding the development of inclusive gender equality plans and policies, and in addressing bias in research assessment with national funding organisations.

National level ministries, science academies, trade unions:

- Conduct **national reviews and monitoring** of institutional responses to COVID-19 and their long-term effects, including a gender perspective, and highlighting good practices;

- **Showcase/award institutions that have successfully considered the impact of gender during COVID-19** and implemented specific actions to reverse this impact to inspire and motivate other HEIs.

Research performing organisations and national funding organisations:

- Include a gender impact analysis in all institutional responses to the pandemic throughout the process: from planning, design, execution, and monitoring of the response, acknowledging and considering existing inequalities;

- Address the long-term impacts of COVID-19 in any **institutional Gender Equality Plan** or equivalent, and design and **implement focused measures to cope with the long-term consequences of the pandemic**;

- **Engage and consult women and marginalised groups, including early-career researchers in policy decision-making** on COVID-19 responses in a participatory way

- Consider and implement **flexible work arrangements as an organisational issue** in research-performing organisations, instead of an individual coping strategy, recognising that the normalisation of such arrangements requires training of line managers and an organisational approach;

- **Improve organisational reflexivity and multi-dimensional, context-specific research assessment**, including guidelines for reviewers, evaluators and decision-makers on how the COVID-19 impact can be assessed in a way that it does not additionally punish women and disadvantaged groups in recruitment and career advancement.

all stakeholders:

- Apply **an intersectional approach** to measures taking into account intersecting barriers and multiple marginalised identities (e.g. single mothers, disabled women, ethnic minorities, migrant or refugee background) to **de-construct the 'universal rhetoric' of the general effect of COVID-19**: COVID-19 did not hit all groups equally and even benefited some.

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2. Early Career Researchers

Aliza Forman-Rabinovici
Tel Aviv University (Israel) and
Occidental College (Israel, USA)

Thais França
CIES-Iscte, Instituto Universitário de Lisboa (Portugal)

Marc J. Lerchenmueller
University of Mannheim and Leibniz Center for European Economic Research (Germany)

2.1. Overview

2.1.1. Summary

After the onset of the COVID-19 pandemic in December 2019, evidence rapidly emerged that the ramifications for scientists and scholars were being experienced differently by women and men, and by young versus seasoned researchers (Royal Netherlands Academy of Arts and Sciences, 2022; Woolston, 2020). Research-performing institutions enforced hiring freezes and halted training programmes (Harrop et al., 2021); researchers were cut off from labs, resources and lab personnel; international conferences, exchange programmes, and further networking opportunities moved to digital platforms (Termini and Traver, 2020). These ramifications combined put Early Career Researchers (ECRs) – doctoral trainees and postdoctoral scholars in the transition to faculty – at an immediate disadvantage in their career development. This chapter specifically focuses on the impact of COVID-19 on ECRs (Termini and Traver, 2020; Harrop et al., 2021).

Even before the COVID-19 pandemic, ECRs were experiencing precarity in the prevailing structures of academic science. In the last 20 years, **casual academic contracts – fixed-term, part-time, project-based**, etc. – alternated with **periods of academic unemployment** have been the norm for ECRs across many countries (Hughes, 2021; Murgia and Poggio, 2018). Thus, ECRs tend to have few prospects for permanent positions, face low funding and are confronted with high levels of competition and little social security given the limited number of permanent positions in academia (Herschberg, Benschop, and van den Brink, 2018). Thus, for ECRs who were trying to build networks, internationalise their careers, establish their own research agendas, and secure funding to bolster

publishing rates, the disruption brought by the COVID-19 pandemic meant that they found themselves cut off from mentors, resources, research time and networking; international collaboration opportunities were reduced, and some of them missed job offers abroad due to travel bans (López-Vergès et al., 2021). Conversely, COVID-19 in some cases brought increased workloads due to more teaching or different forms of teaching (online and hybrid) as well as from providing additional administrative services (Kınıkoğlu and Can, 2021). Overall, the COVID-19 pandemic augmented ECRs' labour-related uncertainties around their progression in academia. Preliminary data from the Harbinger-2 Early Career Researchers and the Pandemic research project shows that the global health crisis also affects ECRs' plans to pursue an academic career and **many of them were in fact planning to leave academia** (Nicholas et al., 2022). This would be a challenging loss for the academic world as the young cohort is at the frontline of research activities.

There is a close connection between the impact of COVID-19 on ECRs and societal responses to the pandemic. Evidence from Germany showed, for example, that women not only took over the physical load of increased childcare and household responsibilities, but also a non-negligible mental load associated with taking care of family matters during the COVID-19 pandemic (Czymara, Langenkamp, and Cano, 2021). Gender differences in shouldering family work are not unique to the pandemic as studies that were pre-COVID-19 pandemic repeatedly documented these patterns in surveys of scientists and academics (Jolly et al., 2014). Nonetheless, the **pandemic served as a magnifying glass for gender disparities in science**. Women ECRs, more so than senior researchers, were impacted by school closures and the loss of childcare frameworks. The ECR stage often coincides with the start of a family. Many ECRs, especially women, had to balance the challenges of work and care under even more difficult conditions than before the pandemic. The presence of children at home was one of the biggest determinants of loss of productivity and loss of time in general (Myers et al., 2020; Oleschuk, 2020), with women affected to a greater extent (Kasymova et al., 2021; Krukowski, Jagsi, and Cardel, 2021). With school closures, women disproportionately (Alon et al., 2020; Royal Netherlands Academy of Arts and Sciences, 2022) found themselves with increased caring responsibilities (Kasymova et al., 2021; Krukowski, Jagsi, and Cardel, 2021). In a study of Dutch academicians, it was found that **women with children at home were also more likely to be in the earlier stages of their career, and in temporary work positions, compared to men with children** (Bol, Derks, and Poorthuis, 2021). Moreover, single mothers were particularly affected as they had to bear the mounting responsibilities by themselves (França et al., 2023; Ségeral, 2021).

Women ECRs may perhaps have been the academic population most impacted and disadvantaged by the COVID-19 pandemic. However, they were not equally affected either, as gender inequalities intersect with further factors of discrimination, such as race, religion, ethnicity, disability, sexual orientation etc. (Crenshaw, 1991). Thus, those with other intersecting identities were additionally affected by the disruptions brought about by the pandemic (Shamseer et al., 2021). In Brazil, Black women researchers were the group most impacted by pandemic-related inequities, regardless of whether they were mothers (Staniscuaski et al., 2021). In the American context, Black women academics' mental well-being was strongly affected by the extra burden of mentoring work

performed to support Black and other minority students (Onwuachi-Willig, 2020). Analysis in the Australian context evidenced similar results on how gender inequalities within academia were experienced differently by minority academic workers (Gray et al., 2022). No equivalent data has been found in the European context. Therefore, this chapter focuses on evidence from a binary woman-man and heterosexual partnership perspective when drawing on evidence from the EU area and will selectively include international non-binary evidence for a more nuanced description of the gendered effect of the COVID-19 pandemic.

2.1.2. Framework

The content of this chapter is based on a review of the literature on the impact of the COVID-19 outbreak on women ECRs' careers. The collection of literature includes peer-reviewed articles, government and university reports, professional organisation reports and research notes. In some cases, given the lack of data available, commentaries and grey literature were also considered. Although this material did not always include reliable data, or relied on anecdotal commentary, and mostly adopted a traditional binary analysis of gender relations in heterosexual relations, it offered valuable insights into possible practices and policy suggestions. The scholarship identified on ECRs' career advancement highlights academic productivity, access to resources, professional networks and mobility opportunities as critical dimensions of this process (Ansmann et al., 2014; Laudel and Bielick, 2019; Stupnisky, Weaver-Hightower, and Kartoshkina, 2015). In light of the literature, this chapter first looks at how the COVID-19 pandemic influenced these dimensions. It will then look at how the disruption caused by COVID-19 in each of these dimensions affected women ECRs' careers in terms of retention, recruitment and advancement.

2.2. Productivity

2.2.1. Summary

Productivity in the academic sciences, especially at more junior career stages, mostly equates to publications in peer-reviewed journals (see also Chapter 1). Women ECRs with children experienced, by far, the most marked reductions in productivity during the pandemic, as well as drops in the time they had to dedicate to research. Other common measures of productivity in academia, like teaching hours, also indicate a differential burden placed on women relative to men ECRs.

2.2.2. Findings

Focusing on journal publications as the central currency of productivity, several studies have clearly shown that women's productivity declined relative to men's during COVID-19 (Andersen et al., 2020; Lerchenmüller et al., 2021; Ucar, Torre, and Elías, 2022). Figure 2 shows an increase in the gender gap in first authorships of publications in the life sciences across the globe, comparing publication data from 2020 and 2021 to pre-COVID-19 publications in the same journals in 2019. Almost all countries exhibited a widening of the gender gap, albeit of somewhat different orders of magnitude. Europe was no exception as the detailed map illustrates. **In Italy, one of the earliest countries to be affected by the**

pandemic, women's share of first authorships decreased from 49% before the pandemic to 35% for COVID-19- related publications (dark blue colour scale) (Lerchenmüller et al., 2021). First authorships in the life sciences are generally allocated to the scholars primarily executing the project, and these are more often ECRs. Hence the drop in first authorships underscores the productivity challenges faced by early career scientists.

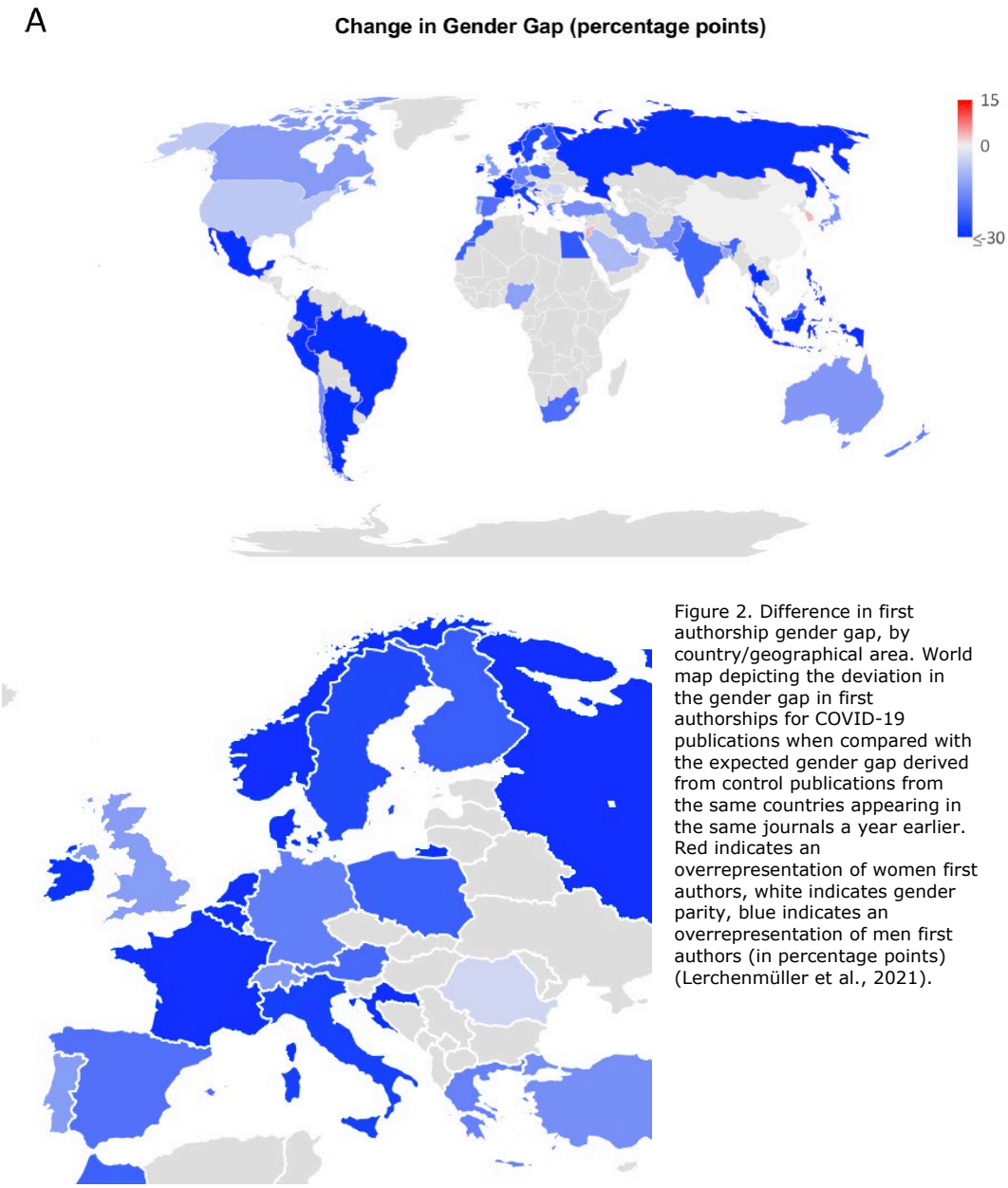

Figure 2. Difference in first authorship gender gap, by country/geographical area. World map depicting the deviation in the gender gap in first authorships for COVID-19 publications when compared with the expected gender gap derived from control publications from the same countries appearing in the same journals a year earlier. Red indicates an overrepresentation of women first authors, white indicates gender parity, blue indicates an overrepresentation of men first authors (in percentage points) (Lerchenmüller et al., 2021).

There were early studies that documented that women also submitted fewer manuscripts overall than men with the onset of the pandemic, both on preprint servers as well as to journals (e.g., Vincent-Lamarre, Cassidy, and Larivière, 2020). But the differential impacts on men and women were also felt on broader measures of productivity. In a study using data from STEM in the United States of America, women, especially ECRs with 0-5 year old children (Krukowski, Jagsi, and Cardel, 2021), were less available for peer review after the onset of the COVID-19 pandemic or attended fewer funding panel meetings, i.e. activities that ECRs stand to benefit from, in particular for visibility and reputation reasons. These early results highlighting the eroding productivity of women, and the widening gender gap for both early and mid-career scientists were confirmed in updated studies as the COVID-19 pandemic progressed (Madsen et al., 2022). Again, these stratified effects by career stage lend credence to the hypothesis that the policy interventions associated with the COVID-19 pandemic led to an unequal distribution of burden across the genders, impairing the productivity of women scientists. Particularly concerning is the fact that the productivity declines affected the previously most productive researchers, who may now be at elevated risk of leaving academia (Madsen et al., 2022).

It is important to note though that this evidence on productivity differentials emerged early in the COVID-19 pandemic. Many of these studies had to accept a trade-off between estimation accuracy and generalisability. Most studies used a case control design studying research dedicated to the COVID-19 pandemic response as the treatment group versus research published in the same journals before the pandemic (control group). Comparing the gender distribution across articles in the case and control group yields fairly accurate estimation about productivity differentials associated with the impact of the COVID-19 pandemic. However, it is by construction limited to research fields that are prone to inform the societal response to COVID-19 pandemic. Gender gaps in more distant fields, like astronomy or elementary physics, would not be represented by these research designs (Andersen et al., 2020; Hoisl et al., 2022).

To get a broader perspective, one needs to look beyond archival evidence into surveys of scientists conducted during the pandemic. Myers et al. (2020) carried out an encompassing survey of faculty at institutions across the United States and Europe, finding that the total work time of academics and scientists reduced by 10% overall. However, this overall effect disguises the fact that research time declined by over 20%. This difference is explained by the fact that while COVID-19 raged, other academic tasks still had to be taken care of. Many administrative tasks had not gone away; some tasks even increased, for example, through the shift to online teaching in the wake of COVID-19 (Myers et al., 2020). Even before the pandemic, women also tended to shoulder higher teaching loads, and more often these were introductory courses that demand more attention to teaching (Malisch et al., 2020). These pre-COVID-19 pandemic gender differences in academic responsibility for teaching also led to a gendered impact of the COVID-19 pandemic on teaching. Women were performing higher levels of emotional work to attend to students' demands than before the pandemic and more than their male peers (Minello, Martucci, and Manzo, 2021). Figure 3 documents how the research time lost in 2020 was quite different by demographic group, women

were more affected than men, and particularly women with children followed by men with children (Myers et al., 2020). The decline in research time was felt equally across the United States of America and Europe, regardless of different cultural norms and differences in critical infrastructure. This pattern indicates that internationally shared social norms and gender roles may have played a critical role in determining the gendered impact of the COVID-19 pandemic. Of note, care work is not limited to children but extends to, for example, taking care of vulnerable family members, especially during COVID-19. Also, time lost very likely stratifies beyond binary gender roles. For more nuanced interventions, further research is needed to better understand intersectional effects.

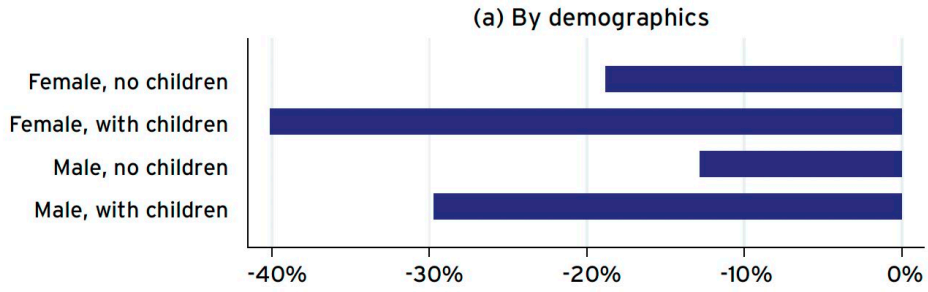

Figure 3. Displays group-level averages of the percentage change in self-reported time spent on research comparing 2019 to 2020. Based on 4 535 full-time academic faculty surveyed in April 2020; see Myers et al. (2020b).

2.2.3. Main challenges

As a result of decreased productivity, there is a risk of also losing the next generation of women scientists and academics. We know from past research that young women in science and academia look to role models who have succeeded in this career (Ginther and Na, 2021). If this loss of productivity in the wake of the COVID-19 pandemic results in fewer women mastering the competitive career in science and academia, this might have knock-on effects for the gender composition of the next generation (Ginther and Na, 2021). Likewise, past research has indicated that certain academic fields benefit particularly from the participation of women. Koning et al. (2021) showed that women tend to produce science about ailments that particularly afflict women (Koning, Samila, and Ferguson, 2021). The same could be expected for other categories of discrimination in healthcare and beyond. Diversity, in the form of gender, race, age and ethnicity, has been shown to benefit research outcomes (e.g., Nielsen et al., 2017; Nielsen, Bloch, and Schiebinger, 2018). If we were to lose women scientists and academics in the wake of the COVID-19 pandemic, this would have broader implications for the health and resilience of our societies.

2.2.4. Existing policy practices

A collection of practices in the European context has been issued by the Coimbra Group of universities. First and foremost, the group recognises that the COVID-19 pandemic placed a differential care burden on women and men, which is reported as a core factor for ensuing gender differences in academic productivity

(Gatti et al., 2020). A central practice has, therefore, become to officially recognise caring as a gender-neutral concept, embraced by all and benefiting all. (Post-)doctoral and Early Career Researchers have been identified as especially vulnerable in relation to reduced time for academic productivity. Counteracting practices include, for example, the creation of a special Task and Finish Group in 2020 to specifically address work-life balance by providing guidance on the impact of COVID-19 on academic careers as an integral part of the University of Bristol's promotion procedures. The University of Cologne put in place a new service agreement on 'mobile work' to complement the service agreement on 'home office' with the goal of better and visibly combining job and private responsibilities. Likewise, the 'Kopf frei' programme relieves postdocs and junior professors of teaching and supervisory duties to make up for time lost in the area of research (University of Cologne, 2022).

2.2.5. Conclusion

Studies in multiple fields have found that throughout the COVID-19 pandemic, women ECRs experienced marked drops in productivity relative to their male counterparts and more senior scholars. They experienced a greater loss of time for research and a marked drop in first-author journal publications. As publications are a rather immediate measure of productivity, the loss of research time will likely spill over into future productivity through challenges in winning external funding, being hired, or maintaining research teams and so forth**. If policies are not implemented to address the outcome of decreased productivity, European academia and science are at risk of losing talent in the current and the next generation of women scientists and scholars.** Scholars experiencing multiple forms of marginalisation might be even more affected by these trends but are currently invisible in standardised data collection efforts. Dedicated research pinpointing the most vulnerable and affected groups is needed to develop targeted interventions to reduce inequalities in the European Research Area.

2.3. Resources

2.3.1. Summary

The impact of the COVID-19 pandemic in terms of resource access for men and women scientists and academics is challenging to assess. This is at least in part explained by the fact that the institutional response to the COVID-19 pandemic differed across EU Member States (Hanson et al., 2021). Since science policy is largely the responsibility of the individual Member States, research and higher education institutions as well as regional funders have responded to the consequences of the COVID-19 pandemic differently. So, while we were able to get a fairly uniform picture of the pandemic's effect on gendered productivity across places, we needed to look explicitly beyond Europe for inferences about the likely impact of the global health crisis on access to resources for ECR men and women.

In this sub-chapter, we look at the key resources needed to establish an academic research career, namely time, trained personnel, (field) data, and funding. We find that all of these were reduced during the COVID-19 pandemic, although the

degree to which they were reduced differed between fields. Given that **women are represented more in resource-dependent fields, e.g. biology and chemistry** (Myers et al., 2020), they might have been disproportionately affected by these reduced resources. Further, policies that gave academic time extensions have had disparate effects for men and women in the past (Antecol, Bedard, and Stearns, 2018), with **women more often using that time for necessary childcare, while men tended to use these extensions for performing professional duties.**

2.3.2. Findings

Time is arguably the most critical resource for Early Career Researchers. Generally, ECRs are employed in arrangements where their productivity is evaluated in a certain academic time frame (i.e. tenure clocks). Therefore, it is not surprising that stakeholders, including researchers, university councils and funders, advocated for the extension of tenure clocks to mitigate the impact of the COVID-19 pandemic on the young research workforce. This policy measure was not unique to Europe (Fulweiler et al., 2021; Oleschuk, 2020). In the United States, 90% of surveyed institutions of higher education homogeneously offered a one-year tenure clock extension (Myers et al., 2020).

This gender-neutral policy response to the COVID-19 pandemic stands in stark contrast to the previously described heterogeneity in terms of researchers being impacted by the pandemic. The previous section documented how women were disproportionately affected compared to men, and women with young children in particular lost valuable time for academic work. Past studies have also demonstrated that gender neutrality in terms of policy responses does not always equate with gender equity. Antecol, Bedard, and Stearns (2018) showed that **additional time granted on tenure clocks in the event of childbirth particularly benefited the productivity of men rather than women**, showcasing unintended consequences of gender neutral policies that do not necessarily translate to equitable outcomes in the science arena (Antecol, Bedard, and Stearns, 2018). In addition to the heterogeneity in terms of time lost across demographic groups, there is also heterogeneity across fields of science. Figure 3 shows that in particular fields that require access to field sites and on-campus infrastructure, like laboratory environments, that are resource intensive in terms of funding and personnel,

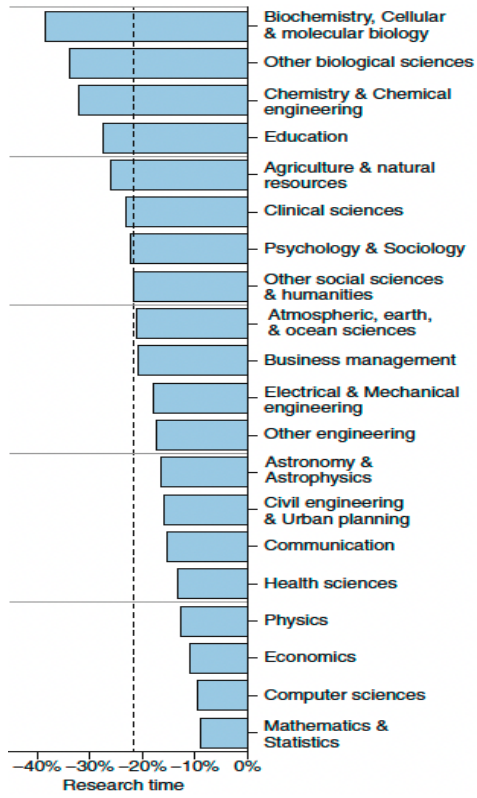

Figure 4. Field-level average changes in research time due to COVID-19. Based on 4 535 full-time academic faculty surveyed in April 2020; see Myers et al. (2020)

experienced the strongest setbacks in research time lost (Myers et al., 2020). Contrasting these infrastructure- and funding-heavy fields with less resource-intensive STEM fields like mathematics and computer sciences, there are many fields that were a lot less affected by the pandemic than biology or chemistry. It is likely that this stratification by field reinforced the unequal effects by gender, since women's representation is particularly pronounced in the most affected fields of biology, chemistry and education ranging from a 66% to 55% share of women among doctoral candidates, for example (e.g., European Commission, Directorate General for Research and Innovation, 2021).

The gender-neutral policy responses designed to mitigate the consequences of the COVID-19 pandemic put additional strains on research and higher education institutions' budgets that would likely need to be compensated by third party funders, particularly in research intensive fields. The Coimbra Group of universities, for example, have pointed out that they would like to support their research staff with additional budget extensions but that they are limited by the overall costs shouldered for pandemic-related countermeasures. As such, external funders, like the European Union or national funders, may need to step up too (Gatti et al., 2020, p.31).

2.3.3. Main Challenges

In exacerbation of the above-mentioned resource challenges, many scientific and academic institutions also responded to the COVID-19 pandemic by freezing recruiting. This is especially challenging for Early Career Researchers. The **suspension on hiring doctoral students and research assistants will create a double obstacle to Early Career Researchers** (Gibson et al., 2020). They will not find financial opportunities to support their academic career and they will not be able to create preliminary data for future grant funding applications (Gibson et al., 2020). Even worse, some ECRs at the early doctoral stage might not find employment. Fiscal shortages foreseeable as the result of public budgets addressing the COVID-19 pandemic will likely add to the challenge of a future funding crunch that could impair women ECRs' progress relative to men's as less availability of funding will probably reinforce existing gender biases in funding allocations (Witteman, Haverfield, and Tannenbaum, 2021). Slowed progress may materialise especially at the intersection of disadvantaged groups, like gender and race, where there exists evidence that without the needed support these groups face both material challenges in being funded as well as challenges in scaling scientific output (Ginther et al., 2011; Kozlowski et al., 2022).

ECRs, and particularly women, are negatively affected by diminished resources, including time, funding and personnel. Due to documented gender differences in access to funding, differences in time use connected to caring responsibilities, and different needs for personnel based on the field of research, women ECRs may be more disadvantaged in a less resource-rich environment moving forward.

There is also likely to be a gendered challenge in accessing funds from funding agencies external to the university sector (e.g. national research agencies). **The previously outlined time lost on research for women versus men will likely put women ECRs at a disadvantage in competing in mid-term or**

future grant rounds. Many grant application processes require preliminary data to successfully compete for funding. With research time lost, it is likely that women ECRs will face a greater challenge in competing for funding.

2.3.4. Existing policy practices

A core resource challenge that emerged with the pandemic is the fact that funders offer project extensions but rarely offer the material means for continuing the research. This dichotomy creates a crisis in personnel costs, especially for ECRs, who can rarely draw on funding or personnel cushions. In May 2020, the German Research Foundation (DFG) started offering the possibility of **applying for additional funds with minimal bureaucracy** in order to continue and complete research work, which could not follow planned procedures due to the lockdown measures (German Research Foundation, 2021). To support equal opportunity during the pandemic, funding recipients could also specify in the '**emergency support**' **application, whether additional financial resources were needed, in case of staff absences to care for children** due to the closure of daycare, schools and other care facilities. Similarly, in July 2020 the Irish Higher Education Authority started offering a **COVID-19 Cost Extension Fund** (Irish Universities Association), for researchers whose work was seriously disrupted by the lockdown, due to dependencies on access to laboratories, research facilities, archives and field sites. More funding agencies should consider accompanying project extensions with financial support.

2.3.5. Conclusion

Women and men experienced the decreases in resources during the pandemic differently. Because women tend to be in fields that require time in labs, like biology and chemistry, with 60% women among doctoral graduates, and extensive external funding, women, particularly in their early career stages, may have been more impacted by changes during the pandemic.

These changes included, but were not limited to, having less time, less money and less opportunity to do research. In turn, these disadvantages are likely to have led to women having created fewer preliminary data, thus reducing prospects for future funding and career prospects more generally. That said, certain practices have emerged that may mitigate the negative effects of the pandemic on women researchers and further analysis and effort is needed to translate these and more practices into equitable career prospects.

2.4. Mobility

2.4.1. Summary

Physical international academic mobility is central to Early Career Researchers' professional progress as it supports networking, raises international visibility, and offers the opportunity of being confronted with different theoretical and methodological frameworks. Hence, its positive impact for ECRs' career has long been acknowledged by the literature (Jons, 2011; Leemann, 2010; McAlpine, 2012; Ackers, 2008). At the policy level, it has also been highly praised. The European Research Area (ERA) has systematically invested in facilitating scholars' mobility within and outside the EU (European Commission, Directorate General Research and Innovation et al., 2021). Mobility is a crucial dimension of the ERA's main ambition of promoting a borderless market for research, innovation, and technology across the EU. The ERA strives to create "'*[a]n open labour market for researchers', in which highly skilled people can move to where their talents can be best employed.*" (European Commission, Directorate General Research and Innovation et al., 2021). The support provided to mobile researchers by the EURAXESS service network has been key in enabling EU and non-EU researchers to relocate easily within the EU. In 2005, the EC started to promote and highlight the importance of virtual mobility for scholars (European Commission, Directorate General Research and Innovation, 2005). This option has been undervalued both by scientists and academics, and by institutions in comparison to traditional physical mobility (Storme et al., 2017). However, the outbreak of the COVID-19 pandemic disrupted most physical international scientific mobility models worldwide (El Masri and Sabzalieva, 2020; Gan, 2021), and pushed many ECRs to unpreparedly engage in virtual mobility schemes (Finardi and Guimaraes, 2020; Goebel et al., 2020; López-Vergès et al., 2021).

Despite the importance of international academic mobility to ECRs' careers and the unplanned expansion of virtual mobility schemes due to travel bans during the first two years of the global health crisis, the literature on the aftermath of COVID-19 for women ECRs (Harrop et al., 2021; Herman et al., 2021; Jackman et al., 2022; Kasymova et al., 2021; Minello, Martucci, and Manzo, 2021) has overlooked the impact of physical mobility restrictions on their careers, as well as the potential and risks of virtual mobility. Overall, the few scientific papers and documents addressing how the impossibility of taking part in physical international mobility due to border closures or restrictions on access to scientific and academic facilities and institutions (libraries, laboratories, archives etc.) affected ECRs do not consider how gender inequality/differences shaped their career opportunities. Furthermore, most information available on the impact of physical mobility restrictions on ECRs lacks consistent empirical background. Equally scarce are data on the opportunities and challenges brought by the dissemination of virtual mobility schemes for women ECRs. Considering the unparalleled disarray of all kinds of physical mobility in 2020-2022 and the centrality of international academic mobility for ECRs' professional trajectory, this scant knowledge is rather disappointing. Likewise, the lack of studies looking at the role of virtual academic mobility during periods of restricted mobility is regrettable as adoption grew intensively within the academic community. Lastly, the abundant literature that has been produced on the impact of the COVID-19

pandemic on international mobility at the undergraduate level (Almukhambetova and Kuzhabekova, 2022; Nurfaidah et al., 2020; Pazmany Peter Catholic University, Hungary et al., 2021) raises the question of why its impacts at early scientific and academic career levels have not given rise to interest and concerns to the same degree.

2.4.2. Findings

Comprehensive investigations into the impact of the disruption of physical international academic mobility for women ECRs brought about by the COVID-19 pandemic are still missing; however, the topic did gain some visibility in scientific and academic debate. Given the value of an experience abroad in improving qualifications, acquiring new skills and constructing personal networks, it has been acknowledged that the loss of internationalisation opportunities due to travel bans will have long-term impact on women ECR's professional path (Herman et al., 2021). Considering that the **early stage of a researcher career often coincides with the childbearing years, and parenting responsibility traditionally affects women's mobility opportunities more than men's** (Hughes, 2021), it could be expected that those women ECRs who were not able to move abroad during the COVID-19 pandemic years might have fewer opportunities in the future to go overseas as parenting responsibilities might emerge. This lack of international experience will put them at a disadvantage, limiting their chances of finding permanent positions.

Nevertheless, virtual mobility also offered novel opportunities for the participation of ECRs, especially women, with caring responsibilities or other personal circumstances which complicate participation in physical mobility. **Virtual meetings and collaborations did give significant amounts of flexibility to many who had difficulty coping with the demands of a more rigid system promoting more equity in science** (Goldin, 2014). Virtual conferences demonstrated a clearly discernible improvement, in some cases by orders of magnitude, across inclusion metrics (Skiles et al., 2022). Despite not being able to go abroad, some women and underrepresented ECRs had the opportunity to continue building their international careers and networks by attending conferences, participating in training programmes, receiving mentorship and joining research teams virtually. Additionally, considering the high costs involved in international and scientific mobility, virtual mobility schemes also facilitated engagement with international scientific and academic environments as the travel expenses were inexistent and conference fees were reduced.

At the outbreak of the COVID-19 pandemic, the European Cooperation in Science and Technology (COST), a funding organisation for research and innovation networks, implemented two Virtual Networking Tools (VNTs), the Virtual Networking Support (VNS) Grant and the Virtual Mobility (VM) Grant(s). These tools consist of grant schemes to support the development of collaborations between researchers that do not necessarily require in-person presence. As these tools were considered successful, they were still in place even after physical mobility resumed (as of the time of writing the report, autumn 2022). During the period of implementation of the pilot (25 April 2020-31 October 2021), 56% of the grants were used by women and 49% by ECRs (Musoglu, 2022).

Analysis of the participation of women in three relevant conference in the STEM field in the United States – Conferences on Learning Representations (ICLR), the American Astronomical Society (AAS) and the North American Membrane Society (NAMS) – which were held virtually in 2020, demonstrated increases between 60% and 260%. Although men's participation also increased, it did so to a lesser extent than women's, between 30% and 121% (Skiles et al., 2022). Moreover, the authors point out that, since women are a minority in STEM fields compared to men, this increase is remarkable and offers evidence of the potential of virtual mobility to boost women ECRs' career internationalisation. Furthermore, their investigation makes it possible to see how virtual mobility has contributed to boosting gender diversity by fostering the attendance of non-binary researchers, trans and gender queer, at conferences.

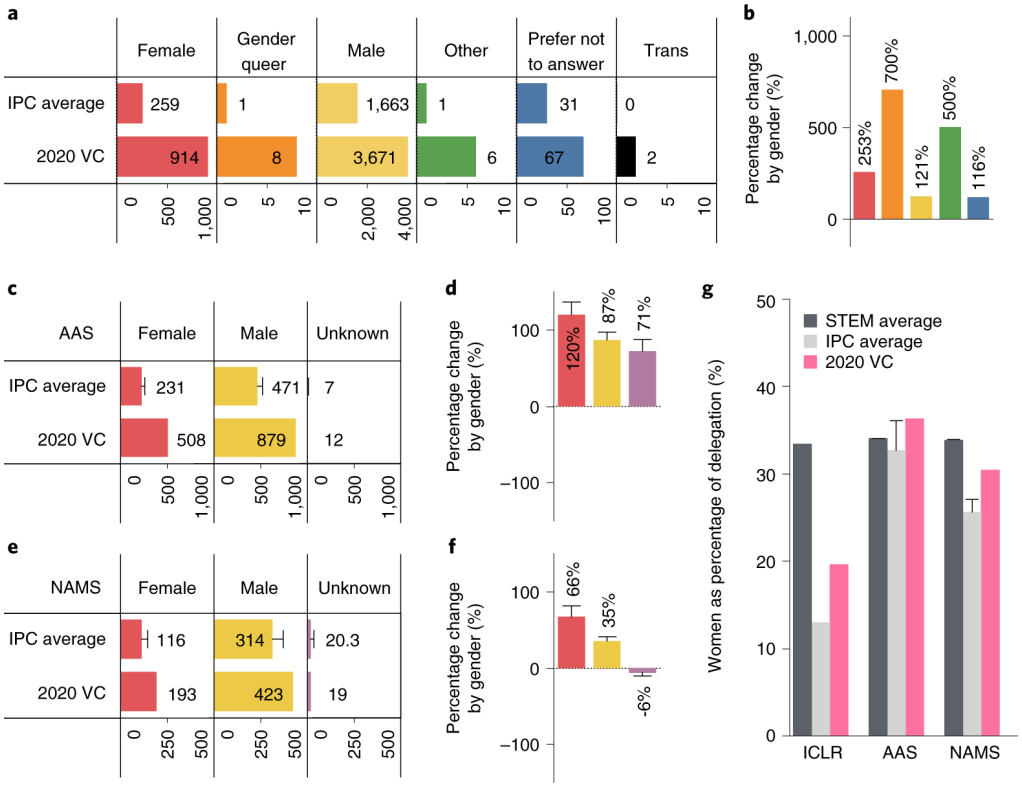

Figure 5. The increase on women's participation in virtual international conferences during the outbreak of the COVID-19 pandemic (Skiles et al., 2022 fig. 2).

Against this background, the shift of some academic mobility activities to **virtual environments** emerged as a **remarkable opportunity for women ECRs** to internationalise their careers, challenging old assumptions that physical mobility was an unavoidable element for a successful career. Despite these potential advantages, Grasenick, et al. (2022) argue that virtual mobility has to be looked at cautiously. Their study indicates that ECR women perceived that during the COVID-19 pandemic their resources and opportunities to develop working relations and approach gatekeepers online were limited, given existing gender

biases operating in academia – such as **women been interrupted more frequently than men during meetings**, lack of previous networking, etc. Virtual schemes can thus mitigate some entrance barriers for women and underrepresented ECRs but might be **insufficient to overcome gender biases** held in direct interaction, limiting the most productive phases of a research collaboration.

2.4.3. Main challenges

Due to the overlap between academics' childbearing age and their Early Career Researcher stage, researchers who want to have children and will actively engage in their care often have a small window of time in the early stages of their career in which they can travel and relocate for research purposes (Hughes, 2021). Many women ECRs lost this window of time during the global health crisis, thus they are now continuing their academic careers without the often-required period of international research experience. These scholars have to plan their next career steps well in advance together with their partners, taking turns in who leads the mobility, looking at destinations where the other partner would also have opportunities and institutions that offer good work-life balance policies. This can lead to a challenging negotiation and coordination process for career plans and family responsibilities (Ackers, 2004; Schaer, Dahinden, and Toader, 2016; Vohlídalová, 2013).

Women are more likely to follow their partners abroad even if the mobility conditions are not ideal for them (Ackers, 2004; Schaer, Dahinden, and Toader, 2016; Vohlídalová, 2013). Owing to travel bans implemented during the COVID-19 pandemic, academic mobility plans had to be suspended, disrupting long-term mobility arrangements. In line with previous studies on the gendered impact of academic mobility, showing **women often postponing their mobility plans to support their male partner's careers** (Ackers, 2004), potentially similar trends could emerge after the COVID-19 pandemic. Studies are needed to investigate potential gendered effects and emerging inequities as physical mobility resumes in the recovery period.

Virtual academic mobility schemes tend to be valued less than physical ones by academic institutions (Shelley-Egan, 2020; Storme et al., 2017), thus representing a less attractive option for women ECRs. In fact, while hybrid models for academic events – conferences, workshops and project meetings – in which there is the opportunity to attend either in-person or remotely seem to be becoming more popular (Garg et al., 2022; Hanaei et al., 2022; Ostler et al., 2021), women ECRs have shown concerns about how to become visible while attending these events online (Grasenick et al, 2022) due to a **lack of gender balance among keynote speakers, the increased risk of being constantly interrupted in the virtual space, and gender stereotypes that underestimate women's digital skills**, aggravating any technical difficulties during online events (Dhawan et al., 2021; Woitowich et al., 2021). Moreover, there are compelling studies that show that physical proximity strengthens scientific and academic collaboration (Catalini, Lacetera, and Oettl, 2015). There is also evidence that **the more complex the underlying science gets, the more it benefits from personal interactions** (Goldin, 2014). Hence, as Grasenick, et al. (2022) have highlighted, the massive adoption of virtual mobility

without considering how existing gender inequalities operate in the online environment might increase the physical mobility gap between those who have care obligations and financial constraints compared to those who do not. As men are traditionally less engaged in care work and hold less precarious academic employment (Ivancheva, Lunch & Keating, 2019; McKenzie, 2022; Murgia & Poggio, 2017), these developments raise concerns about the **emergence of gendered two-tier mobility, in which men would benefit fully from the experience of physical mobilities and women and other genders would be limited to mainly virtual experiences**. Thus, for virtual mobility's full potential to be achieved, more research is needed to understand the quality of these virtual schemes, how ECRs' experience them, and how institutions can benefit from ECRs' engagement in these mobility modalities.

2.4.4. Existing policy practices

During 2022, physical academic international mobility has somewhat resumed. However, mitigation strategies to redress the negative impact of the suspension of international immobility in the last two years on women ECRs are still incipient. Investments and improvement in virtual mobility schemes have been presented as one example of a good practice for promoting women and gender minority ECRs in the COVID-19 pandemic aftermath. Despite the aforementioned disadvantages, virtual mobility can also open up opportunities for women and gender minority ECRs, especially in terms of their research dissemination and international networking, and in particular for those with caring responsibilities (Sander, 2020). Additionally, it can also compensate for the limited travel budget of many women ECRs, who, because of structural gender inequality dynamics within academia tend to be overrepresented in precarious positions (Ivancheva, Lynch, and Keating, 2019; Murgia and Poggio, 2018)

Therefore, some research institutions are offering support and assistance with the use of tools for online networking in events, virtual dissemination and public engagement. Likewise, they are also incorporating virtual mobility schemes and remote mentoring programs as part of their internationalisation strategies (University of Edinburgh, 2020).

Table 2. Virtual mobility advantages for ECRs

Advantages	Disadvantages
Increased participation in international events, due to reduced costs and better balancing of care responsibilities	Fewer opportunities for networking and establishing soft ties
Join remote mentoring programmes	Difficulty in achieving visibility, especially when faced with gender discrimination due to stereotypes and biases.
Increased opportunities for collaboration in international projects	Disrupted participation: Infrastructure problems (Poor internet bandwidth, equipment etc.), distractions by care responsibilities
Strengthening the existing network	Diminished recognition compared to in-person mobility

Improved work-life balance	
Enhanced digital skills and competences needed in the new era of digital transition	

Initial recommendations have been made on how to mitigate the losses caused by physical mobility restrictions at the beginning of this decade and the subsequent expedited adoption of virtual mobility schemes. These include funding and prioritising opportunities to go abroad for women ECRs, acknowledgement of the potential of virtual mobility schemes, and postponement of physical mobility stays (Fisher et al., 2021; Hoggarth et al., 2021).

2.4.5. Conclusion

International physical academic mobility continued to be key to women ECRs' professional path despite the disarray brought by the COVID-19 pandemic. While, the limitation of international mobility opportunities during the first two initial years of the global health crisis (2020-2021) raises concerns about women ECRs' future career progress, the expansion of virtual mobility schemes emerged as a potential alternative for those who have been marginalised with respect to corporeal mobility. This almost contradictory view on the impact of the aftermath of travel bans on women ECRs attests the need for more investigation of the topic.

The analysis here indicates the need to promote further opportunities for those women ECRs who had their plans to go abroad disrupted by the mobility restrictions imposed by the global health crisis. However, at the same time, there are strong claims for promoting the development of virtual mobility schemes, as they allow women with personal or institutional impediments and other disadvantaged ECRs to still take part in international activities via the online space.

The preliminary studies on the impact of the COVID-19 pandemic on women ECRs present different perspectives on the transformations of international mobility practices. Therefore, we suggest that more studies on the topic are needed. Despite all the criticisms, virtual mobility has brought alternative opportunities for women ECRs to internationalise their careers. **Thus, instead of giving up the possibilities of virtual mobility, it would be important to investigate how to improve virtual mobility while keeping some of the benefits of physical mobility.** As the benefits of physical mobility in promoting personal and professional development by fostering networking opportunities and the establishment of long-term collaboration, the development of new skills, and raising international visibility continue to be pertinent for ECRs, and particularly women and underrepresented genders in their early career stages, it is paramount to make it more accessible to this cohort. To be truly inclusive these accessibility requirements should take caring responsibilities, potential disabilities and individual access limitations into account.

2.5. What does this mean for gender equality in academic careers?

The previous four sections looked at aspects of ECRs' work that are considered critical for establishing a research agenda and for obtaining long-term positions as researchers. This sub-section therefore looks at two stages of career progression for ECRs, recruitment and advancement, as well as the ECR-stage equivalent in industry, to assess if and how changes in productivity, access to resources, networking, and mobility – because of COVID-19 – might have disparate effects on young men and women researchers.

2.5.1. Recruitment

The recruitment stage refers to the stage in an ECR's career when they are recruited from a precarious position, usually a doctoral or postdoctoral fellowship, into a permanent position. With the transition, a researcher will generally benefit from improved job stability, social benefits and salary compared to their previous, often graduate-level, position. While a permanent position almost inevitably coincides with at least a guarantee of a salary, all additional benefits depend on the location, field of research and type of organisation the researcher will be working in.

COVID-19 had a significant impact on the academic job market. In many institutions, hiring was put on hold indefinitely, leaving a generation of young researchers unable to transition to the next stage in their career. For postdoctoral fellows nearing the end of their contracts, it was often necessary to seek employment in non-academic sectors (Termini and Traver, 2020). With this decrease in academic recruitment, it is plausible that the job market became more competitive as the same number of researchers competed for fewer available positions.

The combination of increased competition in the market, coupled with increased gaps in productivity between women and men researchers, particularly in the ECR stage, might mean that the gender gap in recruitment grew compared to the pre-COVID-19 period. Women could potentially be seen as less viable candidates, unable to compete with men who had less interrupted training and a more linear career progress.

2.5.2. Advancement

Advancement refers to promotions from junior-level ranks of research institutions to more senior positions of professorship or equivalent research positions. Generally, with a higher rank there is increased compensation and the possibility of fulfilling institutional leadership roles, which often include pay benefits, as well as advantages when applying for grants.

COVID-19 had a distinct impact on ECRs, men and women, compared to more senior scientists. In the process of establishing a research agenda, they were cut off from labs and training (Termini and Traver, 2020). Advancement is mostly based on criteria such as number and quality of publications, grants won, teaching records, etc. Many studies have emphasised that, with the drop in

productivity, there will be challenges and slowdowns to advancement if researchers are held to pre-pandemic COVID-19 standards and there might be increased departure from the academic workforce (Termini and Traver, 2020).

We can extrapolate that this effect will be even greater for women, given decreased productivity among women ECRs, and their lack of opportunities to engage in physical mobility activities (Collins, 2020; Vincent-Lamarre, Cassidy, and Larivière, 2020). In fact, in a survey of Dutch academics, women in the ECR stage reported being much less certain about their futures in academia compared to male ECRs as a result of the pandemic (Bol, Derks, and Poorthuis, 2021).

2.5.3. Entrepreneurship in industry

The industrial research and innovation sector includes private technology, development and research companies, as well as start-ups in various stages. There are virtually no data from private companies on how COVID-19 impacted recruitment, retention and advancement in general, or from a gender perspective. In comparison, venture capital (VC) firms, start-up communities, incubator and angel investor collectives have undertaken data collection and reporting projects to observe COVID-19's impact on their field. Therefore, the analysis of how COVID-19 affected the gender gap in industry focuses specifically on start-ups.

In the early months of COVID-19, there was a slow-down in venture capital financing and investment, jeopardising the advancement of all start-ups and tech initiatives dependent on VC funding. That said, by the summer of 2020, investment activity returned to its previous rate, and from there increased (Atomico, 2020). In 2021, there was a significant increase in VC funding in Europe (de Bruin and Munoz, 2022).

There is a relatively high concentration of women in biotech and life science start-ups relative to other tech fields. With the increased investment in these fields as a result of the pandemic, more VC funding might potentially have reached women entrepreneurs (de Bruin and Munoz, 2022). This does not appear to be the case. **In 2018, 4% of VC funding went to women-led ventures, while in the following years it ranged from 2% to 3%.** Despite an enormous increase in VC funding in Europe in 2021, women's relative share still remained at 2% (see figure 5) (de Bruin and Munoz, 2022).

There are indicators that the pandemic has had a negative impact on the gender gap in start-ups and entrepreneurship. A study in Canada found that the early slowdown in VC investment was disproportionately impacting entrepreneurs from underrepresented groups, including women (Croteau et al., 2021). Women entrepreneurs have been hit harder by the pandemic, as all existing barriers to them getting financing and investment have been exacerbated (Villaseca, Navío-Marco, and Gimeno, 2021).

Further, because of COVID-19, there was added pressure and stress on entrepreneurs. Entrepreneurs with care responsibilities were disproportionately affected by this added pressure, as school closures meant children were at home. Many women were primary caregivers, further increasing demands on their time

and energy. Given the pressure and uncertainty, there may have been a loss of entrepreneurship as people choose the stability of employment over the increasingly risky entrepreneurship during an incredibly unstable period (Croteau et al., 2021).

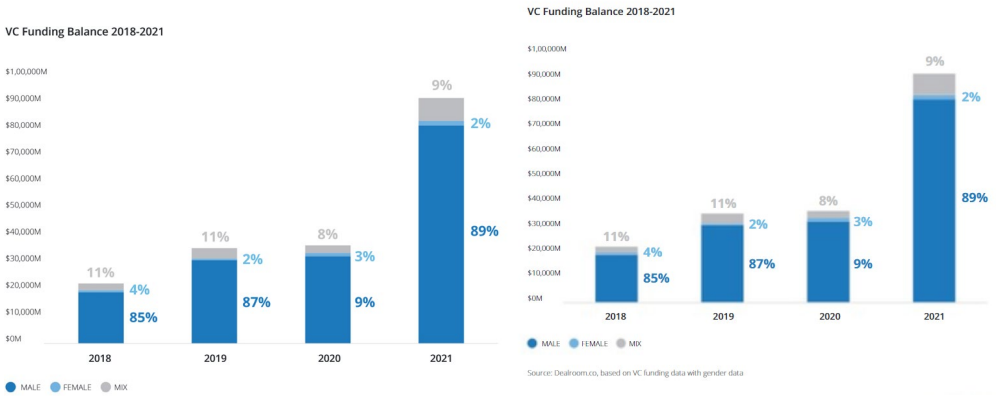

Figure 6. Venture Capital Funding of European startups by Year, Amount and Gender of Startup Founder. Source: de Bruin & Munoz (de Bruin and Munoz, 2022).

2.5.4. Main challenges

There are several unique challenges that changes in productivity, resources, networking and mobility will have for women's advancement in their careers.

1. When applying for new positions, women, especially those with young children, might be at a distinct disadvantage because of decreased productivity during the first two years of COVID-19. There is a risk that progress towards shrinking the gender gap in academia will slow or temporarily reverse. If women, especially those with children, are held to the same standard of pre-pandemic rates of productivity, they will potentially face great difficulty in attaining and retaining long-term positions. The advancement of women (especially those with children) between academic ranks might be slowed by two years of decreased productivity because of COVID-19. While over time, the gender gap in senior professorship positions has become smaller, even though women still represent only 26% here (European Commission, Directorate General Research and Innovation, 2021), this progress could be stalled or even reversed as a result of the COVID-19 pandemic.

2. There may have been a decrease in the number of women entrepreneurs because of potential women entrepreneurs losing funding or pursuing more stable employment during the pandemic.

2.6. Policy recommendations

COVID-19 had a drastic effect on ECRs, and particularly women ECRs. Women ECRs experienced the greatest drops in productivity and resources, particularly research time. Women ECRs with care responsibilities experienced, by far, the most marked reductions in productivity as measured by a growing gender gap in first-author journal and pre-print publications. This gender gap may affect women ECRs' ability to compete in the academic job market, as well as in career advancement. Changes also occurred in international academic mobility practices. Women ECRs have historically been disadvantaged in different aspects of international physical mobility, having both less access to social networks commonly dominated by men, as well as less flexibility in mobility as a result of caring roles. Although new work norms introduced by COVID-19, including virtual mobility schemes, can potentially benefit women ECRs, if gender differences are not taken into account in their design, they might increase the gender gap in academia. Moving forward, actions are needed both to compensate for the lost productivity and resources, as well as to assess the long-term impacts of virtual mobility models, to see if and how they can serve goals of increasing gender equality.

For 2.2 (productivity), we recommend that:

the European Commission and (regional or national) funding agencies:

- **Create guidelines for recruitment and advancement practices** that can compensate for drops in productivity among ECRs, particularly women ECRs, as a result of COVID-19.

- Consider the gendered COVID-19 impact on researchers in the **upcoming revisions of the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers.**

Higher education institutions and research-performing organisations:

- **Provide ECRs** who experienced decreased productivity as a result of the pandemic, and those who had increased care responsibilities as a result of pandemic policies, **with more teaching support or relieve them commensurately of teaching duties.**

- **Review gender-neutral policy interventions** and use evidence-based adjustments of policy to increase the likelihood of gender-equitable interventions.

- **Adjust the criteria used to assess and select candidates for recruitment, advancement and funding**. For example, ask applicants to present their three most productive years out of the last five, and consider candidates based on these years. Another option is to ask candidates to submit their three most successful or impactful papers, and judge candidates qualitatively on their contribution to their field, rather than quantitatively on the number of publications. A third option is to rely less on bibliometric

indicators and, if they are used, to pay attention to systemic gender inequalities.

For 2.3 (resources) we recommend that:

the European Commission and (regional or national) funding agencies:

- **Create funding opportunities that address the specific disadvantages experienced by women, researchers with care responsibilities and gender minorities,** including women Early Career Researchers. These funding schemes could be coupled with a clear description of e.g. care responsibilities and associated loss of productivity during the COVID-19 pandemic. Loss of productivity could be selectively compensated for with contract extensions, salary adaptation and material support.

Member States:

- **Review the impact of policies that merely extend timelines** in funded projects and consider, to the extent possible, supplementing these timeline extensions with financial extensions.

- **Monitor sex and gender** breakdowns in recruitment, retention and advancement during the recovery period and beyond. As intersectional gender-related inequalities could increase, data collection needs to be inclusive to allow for effective and actionable monitoring.

For 2.5 (mobility) we recommend that:

the European Commission, (regional or national) funding agencies and Member States

- **Safeguard funding to previously existing initiatives** for gender equality.

- **Provide financial commitments** to foster and support the development of new equality initiatives.

the European Commission and (regional or national) funding agencies:

- **Create new funding opportunities for international academics exclusively for ECRs with caring responsibilities and systemic barriers to access**, especially for those who were not able to have these opportunities due to the travel bans imposed by the global health crisis. Furthermore, existing initiatives, such as Erasmus+, Horizon Europe and Marie Skłodowska-Curie postdoctoral fellowships should include affirmative actions towards women ECRs who were affected by disruption cause by the COVID-19 pandemic. Gender balance should be considered in all initiatives promoting internationalisation.

- **Create investigation lines and task force groups** to take stock of the state of the art, as well as of the existing data, and to analyse women ECRs' international mobility patterns prior to, during and after the COVID-19

pandemic. To allow for targeted actions, an intersectional approach including information about different dimensions of inequality should be employed.

Scientific associations, funding agencies and universities:

- **Offer academic institutions clear guidelines, training opportunities and financial resources** to support, develop and implement virtual and hybrid/blended mobility schemes that allow for adequate participation for those who are participating remotely.

- **Give the same value to virtual and hybrid/blended mobility participation** as they do to in-person mobility participation when assessing merit and future potential in the process of recruitment and promotion of ECRs' careers, as suggested by the EU Human Resources Strategy for Researchers (HRS4R) guidelines (European Commission, Directorate General for Research and Innovation, 2023).

- **Invest in the development of adequate virtual and hybrid/blended mobility infrastructure** – network bandwidth, software, virtual networking applications, and equipment – that allow for virtual mobility to be as efficient as possible.

- **Provide institutions and funders with guidelines and financial resources** for developing and implementing partner hiring policies in an effective and fair way as well as following ethical principles.

Higher education institutions and research-performing organisations:

- **Systematically collect data about the intersectional dimension of gender inequality** by addressing other potential grounds for discrimination, such as race, ethnicity, disability, and sexual orientation in accordance with national laws and the GDPR (General Data Protection Regulation).

- **Monitor the participation of women and gender minority ECRs** in international academic mobility programmes.

- **Collect and disseminate gender-disaggregated data** on the recruitment and retention of international ECRs.

- **Offer training for researchers** in the development of virtual mobility skills and an introduction to online collaboration tools to encourage their use.

- **Extend the period during which ECRs with caring responsibilities and systemic barriers to access can apply for mobility grants**, giving priority to those who had their mobility plans disrupted because of the COVID-19 pandemic.

- **Explore the opportunities available through Erasmus+, Horizon Europe, Digital Europe and other EU and national instruments to foster transnational institutional collaboration** that can create opportunities for women ECRs to engage in international academic mobility schemes.

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3. Care responsibilities, new working modalities, gender-based violence, work-life balance, and wellbeing

Éva Fodor
Central European University (Hungary)

Lucio Pisacane
Italian National Research Council (Italy)

María López Belloso
University of Deusto (Spain)

3.1. Overview

3.1.1. Summary

This chapter addresses the main issues that the COVID-19 pandemic has raised in the field of higher education and research in relation to care, work-life balance and violence. The focus of the literature has mainly been on the impact of the pandemic on academics' productivity and on functional changes, such as a shift to online teaching; however, from a gender perspective, the impact of COVID-19 on care work (domestic and academic), gender-based violence and work-life balance are highly relevant. Some of the main challenges identified in this chapter are a lack of comparable data, the difficulty in establishing barriers between professional and working life, and the impact of this difficulty on the wellbeing of academics.

3.1.2. Framework

This chapter is structured in four sub-chapters. The first sub-chapter focuses on care responsibilities and the main inequalities that these have generated from a gender perspective.

Many inequalities were caused by new forms of work driven by COVID-19 and lockdown. These new patterns of work, their consequences, and the opportunities that can arise from them are addressed in the second sub-chapter.

The third sub-chapter focuses on gender-based violence and the impact of COVID-19. Given the lack of reliable data, the sub-chapter was challenging to develop. It is already difficult to collect information on gender-based violence

under usual conditions; it was increasingly so during COVID-19. While some projects have addressed gender-based violence in higher education and research institutions, they do not yet provide data on the incidence of gender-based violence during COVID-19. The need for more research in this area is one of the main conclusions of this chapter.

The fourth and final chapter focuses on work-life balance and the impact that COVID-19 and the measures implemented in the sector have had on the wellbeing of academics, specifically women academics.

Challenges: An extra care burden exacerbated existing gender inequalities and created a *care ceiling*. The lack of systemic and comparable data hinders the analysis of COVID-19's impact. Home-based telecommuting can negatively affect work-life balance, reaffirming gender imbalances in household and care responsibilities. Predominant gender roles in academia link work-life balance with traditional family and motherhood. Working from home creates an overlap between private life and work, blurring the borders between personal and professional environments, and resulting in difficulties in disconnecting. It can lead to **digital fatigue, online psychological burnout**, **and difficulty concentrating and focusing for parents and others with care responsibilities**. New leadership is needed in research teams based on relationships and motivation rather than a control or authoritarian approach. During the pandemic, women academics prioritised teaching tasks over research tasks, as they shoulder most of the academic domestic work at the cost of their productivity, mental health and well-being.

Opportunities: The structural changes to the system have also generated some opportunities. Working online can generate flexibility in managing working hours, save time from non-commuting or travelling, and increase the possibility of a good work-life balance if family or parenting services are available. It can increase the possibility of participating in scientific events previously restricted to in-person participation (with associated travel and subsistence costs) and offer the possibility of planning housing choices independently from the physical office with a relevant impact on household budgets. Furthermore, it can support assessments based on productivity/results rather than physical office presence. The pandemic can provide an opportunity to rethink the notion of excellence and promote a sustainable academic environment that helps care for academic staff and the planet.

3.2. Care responsibilities

3.2.1. Summary

During the lockdown periods due to COVID-19, domestic responsibilities increased for most households, and exponentially so for households with children or other dependents, who could no longer receive ongoing care in external institutions. Women globally tended to shoulder more of this increased care burden than men. In the R&I sector, and specifically in academia, this led to both short-term and longer-term inequalities in the distribution of paid and unpaid work, and opportunities for doing research work and publishing.

At the same time, COVID-19 opened up opportunities for positive change as well. Online forms of education and research collaborations, which proliferated during the lockdowns, are expected to transform the way academia works in the long run, allowing more flexibility for employees with various other types of extra-work responsibilities. Second, the importance of mental health care and dedicated teaching increased during COVID-19, which may lead to a positive re-evaluation of these two highly women-typed duties in academic work.

3.2.2. Findings

It is well documented that gender inequality in the distribution of care work increased significantly during COVID-19: women took on disproportionately more childcare and domestic duties than men in those countries where data are available (see, for example, Couch et al. (2022) or Dunatchik (2021) in the United States, Craig (2020) in Australia, Deshpande (2022) in India, Fodor et al. (2021) in Hungary, Guy and Arthur (Guy and Arthur, 2020) and Sevilla and Smith (2020) in UK, Franca et al. (2023) for Portugal, Hipp and Bünning (2021) in Germany, or see Blaskó et al. (2020) and EIGE (2022) for several EU countries, or Goben and Haynes (2021), for an online repository of articles). The pandemic blurred the spatial and temporal boundaries between paid work, domestic labour and care work, and the latter two increased significantly for women. At the same time, however, most research has found that **many men also increased their contributions to childcare and eldercare**, at least in absolute terms. Nevertheless, it was **women who bore the vast majority of the burden of the lockdowns** (Couch, Fairlie, and Xu, 2022; Dunatchik et al., 2021; Craig, 2020; Deshpande, 2022; Fodor et al., 2021; Guy and Arthur, 2020; Sevilla and Smith, 2020; França et al., 2023; Hipp and Bünning, 2021; Blaskó, Papadimitriou, and Manca, 2020; EIGE, 2022; Goben and Haynes, 2021). This was true for couples where both partners could work from home: even in this context, women tended to remain responsible for more childcare duties (Blaskó, Papadimitriou, and Manca, 2020). For families where parents had to keep working outside the home, solving childcare proved a major challenge. Women tended to take on this responsibility more than men, increasing work-life balance problems (EIGE, 2022; Eurofound, 2020). There is significant variation in the degree of the gender care gap across countries, but it is difficult to make a reliable comparison based on available data. Nevertheless, scholars have called attention to the importance of differences, not only across countries but also among women in terms of age, ethnicity, migration status and household type (Blowers, Johnson, and Thomson, 2022). In a Hungarian study, gendered childcare difference was a particularly acute phenomenon amongst middle-class, highly educated and urban families/women (Fodor et al., 2021). Mothers with young children reduced their paid employment four to five times more than fathers, with the gender gap in work hours growing by 20-50% (Collins, 2020; Myers et al., 2020). Andrew et al. (2020) show that 47% of mothers were caring for children whilst simultaneously doing paid work, compared to only 30% of fathers.

The constraints faced by academics and researchers during the pandemic were similar but not identical to those in other professional occupations. This is because academic work life allowed – indeed required – an exceptionally great degree of flexibility even before COVID-19 (Ashencaen Crabtree, Esteves, and Hemingway, 2021; Górska et al., 2021): academics tended to have a high level of control over

the time, place and pace of their work. However, academic and research careers can also foster gender biases because they are organised and institutionalised without regard to the typically highly gendered distribution of care responsibilities (Minello, Martucci, and Manzo, 2021; Skinner, Betancourt, and Wolff-Eisenberg, 2020). Overall, women are more likely than men to dedicate time to care work and are more often found in less prestigious academic positions, specifically those which require more teaching and administrative contributions. They might also be more inclined than men to quit their jobs or to accept lower levels of research productivity and a slower career progression including lower pay and to shun leadership responsibilities (Corbera et al., 2020; Ivancheva, Lynch, and Keating, 2019).

The pandemic exacerbated gender inequalities in care work among professional couples. Little direct information is available about those who work in academia or more broadly in the field of research, but the few studies that do exist show a similar trend (e.g. Ashencaen Crabtree, Esteves, and Hemingway, 2021; Górska et al., 2021; Skinner, Betancourt, and Wolff-Eisenberg, 2020; Boncori, 2020; Akanji et al., 2022). These studies confirm that in academia women were more likely than similar men to take on care work and thus reduce their employment, were less productive and more ready to quit their jobs (Matulevicius et al., 2021). As in the case of women in many other professional couples, the double burden of paid and domestic work contributed to an **increased level of stress and mental health problems among academic women** (Guy and Arthur, 2020). Studies on academia often highlight the personal struggles and compromises women and couples were forced to make (e.g. Guy and Arthur, 2020; Bowyer et al., 2022). As demonstrated above, most of the literature on gendered differences in the life of academics during COVID-19 focuses on the role of parenting. However, beyond the caring for children, ethnographic narratives have highlighted how academic mothers caring for disabled children face additional struggle, including a lack of recognition (Schneider et al., 2021), which has also been observed for single women (Utoft, 2020).

3.2.3. Main Challenges

The extra care burden women shouldered during COVID-19 exacerbated existing inequalities in academia. Simultaneously, this process highlighted the problems that interventions to eliminate inequalities should target. COVID-19 and the ensuing renewed attention to the importance of care are offering a chance to rethink the structure of the academic career track and the notion of excellence as well as their gendered consequences. The collection of comparable, systematic data – both quantitative and qualitative – is essential for this. Currently, the existing evidence is rich in detail but ad hoc in focus, making both cross-country and longitudinal comparisons, or the assessment of the intersectional impact of COVID-19, difficult.

3.2.4. Existing Policy Practices

Few academic and research institutions implemented policies which targeted the impact of COVID-19 in a gender-sensitive way. Nevertheless, many universities did introduce measures which extended the tenure clock, reduced the teaching load, or changed the nature of work evaluations in ways that provided support to

those with caretaking responsibilities (NYU Web Communications, 2021). One example is the University of Central London, which offered special grants to those with increased care responsibilities to help alleviate their work burden. These and similar measures are likely to have been more helpful for women, given the uneven allocation of domestic work, and individuals with care responsibilities, but their impact should be critically analysed to explore their efficacy in reaching the academics most affected by the pandemic.

3.2.5. Conclusion

Although it offers a great deal of flexibility, academic and research work requires immense dedication and time. During the pandemic, many women and people with care responsibilities were forced to allocate more time to care work. This exacerbated existing gender inequalities in the time and energy they had available for research and career advancement. At the same time, the pandemic profoundly impacted working methods within academia, and these will likely have long-lasting effects, which are also impactful from the point of view of gender inequality.

3.3. New working modalities

3.3.1. Summary

Flexible and remote working modalities were not new for the R&I sector, but COVID-19 boosted smart working (SW), and many activities were shifted online, including research project meetings, training, personnel selection and conferences (Alizadeh, 2012; Sullivan and Lewis, 2001). **Of all the socio-economic changes caused by COVID-19 in the R&I sector, the disruption to workforce organisation will probably leave the most permanent mark.** How work is organised in the future will be closely linked to the experience of working during the same institution's response to COVID-19. New working modalities in the R&I sector bring several challenges and opportunities for the academic and research labour force.

3.3.2. Findings

Some studies have explored the effect of the new working modalities during the pandemic period, including surveys among academics and research organisation staff (AbuJarour et al., 2021; Ahmadi et al., 2022; Cellini et al., 2021; Palumbo, 2020; Rijs and Fenter, 2020; Watermeyer et al., 2022). Overall, employees of Italian academic and research institutions mostly appreciated the work time flexibility offered by smart working, the travel time savings it allowed and the fact that it permitted a better balance between work and family time. The negative aspect described by most respondents was the loss of social contact, especially during remote working during the lockdown periods in 2020 and 2021 (Cellini et al., 2021).

The same survey demonstrated some interesting gender-specific results: i) smart working increased the frequency with which men collaborated with women in family and care activities, although the distribution of domestic and family workloads among employees of research institutions continued to be very

traditional (women dealing more frequently than men with activities such as housekeeping, childcare, support for remote teaching activities, elderly care, and meal preparation, while men were more frequently involved than women in activities such as grocery shopping, handling bureaucracy, and minor household repair); ii) most respondents, with a higher share of women, declared that smart working allowed them to experiment with innovative forms of time management for work and care activities, effectively increasing their degree of work-life balance. Overall, the workers at Italian research institutions predominantly judged the smart working experience during the COVID-19 emergency positively and reported that it could represent an important instrument to promote and facilitate work-life balance, especially for women researchers.

3.3.3. Telework, remote working and smart working: background definitions

Even before COVID-19, new ways of remote working had begun to become popular to support greater flexibility and productivity. However, in the analysis of COVID-19 on these new forms of work, concepts such as *smart working*, *remote working* or *teleworking* are often used interchangeably. It is important to note that these three modalities differ from each other.

The EU Framework Agreement on Telework defines telework as "*a form of organising and/or performing work, using information technology, in the context of an employment contract/relationship, where work, which could also be performed at the employers premises, is carried out away from those premises on a regular basis*" (European Trade Union Confederation, 2002) but also regulates its core aspects: voluntariness for both employees and employers; reversibility; equal employment, training and collective rights; data protection; respect for privacy; and employers' responsibility for occupational safety and health (OSH) (Sanz de Miguel, Caprile, and Munar, 2021).

3.3.4. Impact of COVID-19 on working modalities

The lockdown and restrictions on mobility and social interaction resulting from COVID-19 led to a significant increase in the use of teleworking (Eurofound, 2020; Joint Research Centre, 2020). However, the outbreak of COVID-19 revealed large differences in the prevalence of telework across EU Member States, sectors, occupations and gender. The Eurofound report affirms that women worked from home more than men both before and during the COVID-19 pandemic. It attributes this to the greater telework suitability of jobs with high proportions of women employees as well as their need to work from home to undertake caring and housework activities. There is no specific data about the impact of telework in academia.

Recognising that telework and new working arrangements are used to a large extent to reconcile paid work with care and domestic work, usually unpaid, the exploratory opinion requested by the Portuguese Presidency of the EU on Telework and Gender Equality analyses in detail the implications and potential of telework for gender equality (European Economic and Social Committee, 2021). The report argues that, while it is for employers to decide on the organisation of

work, social partners can play a significant role, for example through collective bargaining, in promoting telework in a way that contributes to gender equality.

Lockdowns linked to COVID-19 meant a broad introduction of telework across the EU through different strategies. **National legislation has a key role to play in regulating conditions and access to telework and in considering the gender impact of these new working arrangements on gender equality.** While countries such as France and Belgium were able to impose it with pre-existing legislation that provided for this possibility if the sustainability of companies was at risk, other countries used states of emergency to force its implementation, as was the case in Finland, Germany, Hungary, Italy (although only for the public sector), Poland, Portugal, Slovakia, and Slovenia (Sanz de Miguel, Caprile, and Munar, 2021). The European Economic and Social Committee (EESC) recommends an evaluation of existing rules to assess their effectiveness in the light of the rapid expansion of telework, awareness of new risks and lessons learned (European Trade Union Confederation, 2002).

3.3.5. Main Challenges

Smart working pushes in the direction of transition from hierarchical organisational models based on physical presence to work systems that favour the achievement of results, work autonomy and the spread of relationships of trust (Butera, 2020), with strong innovation in performance achievements (Francesca Della Ratta-Rinaldi, Francesca Gallo, and Alessia Sabbatini, 2021; Giuzio and Rizzica, 2021; Reale, 2022; Canal, Gualtieri, and Zucaro, 2022). Recent studies underline that new working modalities are driving new ways in which leadership is exerted within public or private research organisations, which must go beyond the traditional hierarchical relationship, to favour forms of collaborative and proactive forms of work by the worker (Gastaldi et al., 2014; Reale, 2022; Van der Voet, Kuipers, and Groeneveld, 2016).

A challenge is the inclusion of the right to disconnect in binding legislation, which should include a definition of *working* and *leisure* time that sufficiently captures the need to protect workers from the expectation of work as well as its actual performance, and of the circumstances in which it is permissible to contact workers outside normal working hours. This disconnection has not been possible even in states where it has been recognised in the regulatory framework (as in the case of Spain) due to: (1) the lack of an effective telework plan; (2) the absence of time control in the sector; (3) lack of reaction and adaptation and the disconnection of the rest of the teaching staff; (4) and the omission of information on the right to disconnect in institutional policies and communications (Ramón Fernández, 2021). At EU level, the European Parliament has called for legislation on the right to disconnect and it has adopted detailed recommendations on this (European Parliament, 2021).

A proclaimed objective of teleworking is to support working parents, especially mothers, and reduce gender inequalities in employment (Eurofound and International Labour Office, 2017). While teleworking may make it easier for those with care responsibilities to juggle paid work and care, empirical evidence shows that mothers and daughters more often do a disproportionate amount of housework and care work compared to fathers and sons. This suggests that

teleworking may help address childcare issues but does not necessarily foster co-responsibility between parents or create more gender-equal workplaces unless there is a conscious decision to do so.

3.3.6. Existing Policy Practices

Many academic institutions and research organisations have been supporting new working modalities since the COVID-19 period. Examples of policies include the actions promoted by the Institut Pasteur in France and the Italian National Research Council (CNR).

The Institut Pasteur has implemented an internal procedure within its Gender Equality Plan (Institut Pasteur, 2022) on home working so all eligible employees can benefit from such arrangements and be informed of their right to disconnect. In addition, awareness-raising initiatives on the agreement on working from home have been promoted and internal rules apply for scheduling meetings and seminars at times enabling a good work-life balance (9.30 a.m. to 5.30 p.m.).

The CNR in Italy, as a partner of the Horizon 2020 funded MINDtheGEPs structural change project, in 2021 introduced individual smart working agreements for both research and research support/administrative staff to enable them to have 10 working days of smart working each month. The agreement includes the right to disconnect and availability hours for the smart worker (Scopigno and Giorgi, 2020). This institution is aware of the tentative gendered impact of this measure and has already foreseen analysis of their research production to see *"whether the need to balance family care with research had a different impact on women than men, and to help us proceed towards full gender equality"* (Scopigno and Giorgi, 2020).

3.3.7. Conclusion

We conclude with a set of recommendations for measures to be addressed in any future legislation on the right to disconnect based on a recent report (Bell et al., 2021). Legislation needs to clarify the distinction between working time and rest periods; during the latter, the worker should not be expected to be normally available to the employer. Given the gendered dimension of work-care arrangements, a right to non-availability might be especially relevant for women and people with care responsibilities. Non-availability is key – rest periods must be protected from the risk or expectation of being contacted for work purposes, whether on location or remotely. However, flexibility might be needed under certain conditions, such as extraordinary circumstances, business conducted across time zones, and flexible working arrangements. For such laws to function in practice, it is necessary for them to be implemented by employers with the participation of trade unions or other workers' representatives. To be effective in practice, all workers should be included, and this should encompass non-standard forms of employment.

3.4. Gender-based violence

3.4.1. Summary

Emerging evidence shows that violence against women and girls intensifies in times of crisis – be it COVID-19, conflict or climate change (Peterman et al., 2020). As early as March and April 2020, warnings began to emerge about the potential for gender-based violence (GBV) to increase as lockdowns were imposed, women especially were made to isolate with an abuser, and many service providers were forced to close or limit provision because of mobility restrictions (UN Women and Women Count, 2021). GBV is notoriously hard to measure accurately (EIGE, 2021). However, during COVID-19 alternative data sets became important to understand the trend in violence against women. This included phone calls to national hotlines (Perez-Vincent and Carreras, 2022), and online survey tools (Davis, Li, et al., 2022), one of which identified an up to 23% increase in self-reported experiences of intimate partner violence, particularly when a male partner´s economic position had been affected by social distancing measures (Arenas-Arroyo, Fernandez-Kranz, and Nollenberger, 2021). Hospital data has also become an important source to document the rise in cases of violence (Sidpra et al., 2021).

For future crises policy actions are needed to enhance gender-based violence risk assessments and strengthen prevention measures as part of crisis response and preparedness.

3.4.2. Findings

The COVID-19 pandemic may have exacerbated factors influencing abusive workplace behaviours in general, such as mental health, economic and social inequities.

Between January and May 2022, the Horizon 2020 funded project UniSAFE coordinated the implementation of a survey among 46 participating universities and research organisations in 15 countries in Europe to collect measurable evidence on the prevalence of gender-based violence in academia and research. With over 42 000 responses from staff and students, the survey was the largest conducted to date in the European Research Area. Overall, results showed that 62% of the survey respondents had experienced at least one form of gender-based violence since they had started working or studying at their institution. The prevalence was even higher for respondents who identify as LGBTQIA+ (68% reported at least one incidence), those belonging to an ethnic minority group (69%) and those reporting a disability or chronic illness (72%). Psychological violence was reported as the most prevalent form of violence (experienced by 57%). Moreover, almost one in three students and staff said they had experienced sexual harassment within their institution (31%), whereas 6% of respondents had experienced physical violence, and 3% sexual violence. One in ten respondents reported that their work or studies had been harmed by economic violence. 13% reported having experienced gender-based violence. Almost half the survivors (47%) explained that they felt uncertain whether the behaviour was serious enough to be disclosed. Another frequent reason for not reporting incidences, indicated by 31% of the victims, was that at the time of the

incident they did not identify the behaviour as an act of violence (Lipinsky et al., 2022). However, the UniSAFE survey did not look into the COVID-19 impact specifically.

A Japanese study looked into the effect of COVID-19 restrictions on decreasing research motivations, and found it had a greater impact on women, also quoting anxiety about the future (Miki et al., 2020).

Definitions of the six forms of gender-based violence used in the UniSAFE Survey

Physical violence is any act which causes physical harm as a result of unlawful physical force, e.g. somebody threatened to hurt you physically or pushed you.

Psychological violence is any act which causes psychological harm to an individual, e.g. somebody directed abusive comments towards you, interrupted you or spoke over you.

Economic violence is any act or behaviour which causes economic harm to an individual, e.g. harmed your work/studies through restricting access to financial resources.

Sexual violence is any sexual act performed on an individual without their consent.

Sexual harassment includes unwanted verbal, nonverbal or physical conduct of a sexual nature, such as comments on looks or body, sending of images with sexual content, making sexist jokes or touching you.

Online violence can take many forms, for example, cyberbullying, internet-based sexual abuse, non-consensual distribution of sexual images and text.

Source: Lipinsky et al. (2022)

3.4.3. Main Challenges

Surveying a campus community about sexual harassment can be a daunting task during normal times. It is especially daunting during a pandemic. Institutional leaders may baulk at committing scarce resources to survey efforts. Some may wonder how to interpret results that look dramatically different from prior assessments. Also, they may worry about adding to the burdens of already stressed staff, faculty, and students. Indeed, these concerns and complexities came up recently within the work of the National Academies' Action Collaborative on Preventing Sexual Harassment in Higher Education in the United States (Holland et al., 2020).

The COVID-19 period and the associated increase in sexual harassment requires additional evaluation efforts using climate surveys to assess the prevalence of sexual harassment experiences among R&I staff. Importantly, all evaluation

efforts should consider and examine the experiences of individuals in underrepresented and/or vulnerable groups applying an intersectional approach (National Academics of Science, Engineering and Medicine, 2021).

3.4.4. Existing Policy Practices

The literature review did not identify any existing policy practice in the context of the COVID-19 pandemic. However, from the work of the existing research projects analysed, such as those of AdvanceHE or Universities Scotland, the following appear relevant:

- The creation of social media materials to help universities and colleges across Scotland support staff and students who might have been experiencing GBV and abuse while social distancing measures were in place due to Covid-19 (Universities Scotland, 2023).

- The organisation of webinars and training sessions around the issue of GBV, such as those organised by the APRU Asia-Pacific Women in Leadership Program and the University of Sydney or by the University of Seville in Spain (IgualdadUS, 2021).

- Drafting guidelines on the disclosure of GBV that include the new scenario brought about by COVID-19 and particularly the lockdowns. See for example:

  - Safelives guidance for employers and when suspecting a friend is experiencing abuse during COVID-19 (AdvanceHE, 2020).

  - Equally Safe in Higher Education (ESHE) Toolkit (University of Strathclyde, 2023).

3.4.5. Conclusion

Overall, pre-existing challenges to the collection of reliable data about GBV in the academic context have persisted throughout the pandemic. To date, no robust data are available to document potential changes of GBV patterns in academia during the COVID-19 pandemic. This significantly complicates the development of targeted interventions for prevention and support of survivors.

3.5. Work-life balance and wellbeing

3.5.1. Summary

One of the areas most affected by the COVID-19 pandemic was work-life balance. This impact on work-life balance was mainly the result of three factors: the imposition of remote working, the logic of academic capitalism and neoliberal practices, and the conceptualisation of work-life balance itself. As many articles have pointed out, the inequalities resulting from COVID-19 exacerbated pre-existing inequalities (Górska et al., 2021; Reboiro del Río, 2022; Rosa, 2022). The impact has been reflected in a significant number of articles and reports which have tackled this issue from different dimensions.

When analysing the different positions on the impact that the pandemic has had on work-life balance, the difference between the defenders of the prevailing academic neoliberalism and more critical views of institutional feminism becomes clear. While those aligned with academic capitalism claim that the traditional flexibility of academia was exacerbated during COVID-19 (Athanasiadou and Theriou, 2021; Yüceol et al., 2021), critical feminist approaches point to the *care ceiling* (Bernie, Devine, and Lynch, 2009) as one of the explanations for women's lower productivity and question the current measurement of academic excellence (Blowers, Johnson, and Thomson, 2022). Directly related to the difference in approaches is the problem of the conceptualisation of work-life balance, in which traditional family models still prevail and work-life balance continues to be linked to care, especially for children and potentially for the elderly.

In terms of the impact on wellbeing, the first issue that emerges from the analysis performed here is that many more studies have focused on individual impacts versus institutional impacts, but several authors nevertheless have pointed out the need to delve deeper into institutional impacts (Ashencaen Crabtree, Esteves, and Hemingway, 2021; Corbera et al., 2020; Chung, 2022; Parham and Rauf, 2020; Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021).

Among the individual impacts of COVID-19 on women academics' wellbeing, studies on the psychological impact predominate. **These studies point to an increased workload, including of academic care work, and the dissolution of barriers between work and personal life as the main factors of stress and decreased wellbeing** (Ashencaen Crabtree, Esteves, and Hemingway, 2021; Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021; Lopes, Coelho, and Ferreira, 2021; Bilge, Alkan, and Ağanoğlu, 2020).

3.5.2. Findings

Imposition of telework

Most of the documents consulted agree that the main challenges related to work-life balance are time management and the dissolution of the boundaries between private and professional space (Parham and Rauf, 2020), the need for **greater training in the use of technologies** (Susilaningsih et al., 2021; Zalite and Zvirbule, 2020), in the **use of new teaching methodologies** (Ilić-Kosanović, 2021); the need for a revision of the time needed to adapt to the tasks (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021) is also pointed out. The imposition of telework affected different groups in different ways, since, for example, research staff working in laboratories were not able to continue their work remotely (Marinoni, van't Land, and Jensen, 2020) or service and administration staff, who are very physically present, were not able to transfer their work completely online, with all the consequences this had for their health and safety (Marinoni, van't Land, and Jensen, 2020).

Faced with the closure of academic institutions, most organisations provided their staff with computers or technical resources to be able to continue to carry out their tasks. However, little consideration was given to the need for a suitable working environment, with appropriate space and without having to share technical resources with other people in the household for the proper

performance of teaching and research functions. A study by the Horizon 2020 funded SUPERA project focused on these gendered differences in a complete analysis of the working conditions of the staff of the three institutions participating in the study (Universidad Complutense de Madrid (UCM), University of Cagliari and Coimbra University). The UCM results showed that while complaints about the lack of technical resources were common to both men and women, in terms of access to adequate space, **women reported less access to their own space and a good working environment, largely because they take on many of the care tasks or because of the greater impact on single-parent households** (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021). The results from Coimbra pointed to maternity as the factor hampering the access of women to most resources, with the exception of "open air space at home", while, in the case of men, parenting only played a significant role in the access to a calm environment (Lopes & Cohelo 2021:8) These gender differences were also reflected in the characteristics of housing (size and location), a clear reflection of the wage gap (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021, p.14).

These findings highlight how contingency plans should incorporate a clear gender perspective that seeks to mitigate gender biases arising from the horizontal and vertical segregation that still prevails in the academic environment (Ashencaen Crabtree, Esteves, and Hemingway, 2021).

The influence of the system: academic capitalism as a factor impacting work-life balance.

From our literature review we have been able to identify a clear difference in the analysis of the impact of COVID-19 on academia. While the mainstream considers teleworking and lockdown-related isolation a clear opportunity to increase productivity and a sign of the flexibility of the academic environment (Beck, 2020), critical reviews from the literature with a more feminist approach clearly identify the threats of this discourse to gender equality (Cui, Ding, and Zhu, 2022; Staniscuaski et al., 2021). This critical approach is especially relevant in the analysis of the impact of COVID-19 on work-life balance as it points to structural elements that have been accentuated during the pandemic.

Since academic institutions cannot be gender-neutral because they are no strangers to patriarchal society, the discourse of objectivity, meritocracy and flexibility continues to prevail (Górska et al., 2021). However, numerous studies note the hostility of the academic system towards academic mothers (Górska et al., 2021; Nikunen, 2014) who move away from the working ideal of academia, which is represented by a white male with no caring tasks (Parham and Rauf, 2020; Bleijenbergh, van Engen, and Vinkenburg, 2013). This has meant that academics with caring responsibilities have been hit particularly hard by COVID-19 and especially during lockdown, as measures such as school closures or home schooling, which mainly women had to deal with, have meant that their productivity suffered (Górska et al., 2021).

Górska et al.'s (2021) analysis of women academics in Poland confirms that in crisis situations, such as the COVID-19 pandemic, the alleged flexibility of the academic system advocated by proponents of neoliberal academia was not

perceived by men as a tool for taking on care tasks. On the other hand, women academics advocated for such flexibility to adapt their professional and care responsibilities, even if that meant working evenings or weekends, or reducing their productivity, running up against what Ivancheva et al. (2019) call the *care ceiling*.

Conceptualisation of Work-Life Balance

The third factor which has had an impact on work-life balance in a generalised way, but also specifically in the academic sector, is the conceptualisation of work-life balance as the combination of work and family (Rosa, 2022), imposing a vision of work-life balance directly related to care, and especially to the care of minors.

As Parham and Rauf point out, work-life balance can also involve a balance between paid and unpaid (domestic and care) work (Parham and Rauf, 2020). Despite the widespread perception that work-life balance is conditioned by personal decisions and choices, in the case of the academic sector, work-life balance is a crucial issue given the competitiveness of the sector, and especially since the pandemic, as requirements for immediacy and hyperconnectivity have been consolidated. Furthermore, these authors point to the social construction of time as a conditioning element of what they call an *impossible conundrum*, since for women academics, the time needed to complete their tasks is hardly quality time without interruptions if they have care tasks (Parham and Rauf, 2020).

Although the protection of women with stable contracts has been articulated through tools such as equality plans, there are groups which are currently sustaining the academic system which are usually left unprotected, such as postdoctoral researchers (Rosa, 2022). According to Rosa, this group is particularly affected by the generalised perception of work-life balance and by the neoliberal vision imposed on academia, which promotes total commitment through temporary, part-time contracts, which in many cases involve mobility. Moreover, this perception is based on gender norms that over-understand that this type of profile does not have care commitments or leisure needs, or that all people in academia follow a similar trajectory, linking these profiles with young people with a linear trajectory in academia (Rosa, 2022). This is reflected in the literature on the impact of COVID-19 on this group, which focuses on the impact on their productivity and career prospects, with few studies on the impact on their work-life balance or wellbeing (Woolston, 2020). Among the few articles that address this issue Herman et al. (Herman et al., 2021) collect data from different surveys and find that also middle-aged researchers (51%) and even scholars (16%) were affected by caregiving tasks during lockdown. This article notes the importance of gender in this impact because of their greater traditional burden of both domestic and academic (student supervision) care, providing evidence that the impact on women academics has been greater (Herman et al., 2021).

COVID-19 impact on work-life balance and wellbeing

Most of the documents reviewed emphasise the strong psychological impact COVID-19 has had on academic staff, especially women. Almost all the papers

reviewed note the significant increase in workload and the stress associated with this increase.

The analysis carried out by Ashencaen Crabtree et al. (2021) to analyse the impact of COVID-19 on work-life balance during April 2019 highlighted the increase in workload as one of the main negative impacts of COVID-19 associated with a significant increase in stress. The opinions collected in this study, to which mainly women responded, showed an increase in working hours, mainly associated with the adaptation to online teaching. This increase in workload as well as the conditions in which many academic staff had to carry out their work are also confirmed in several other studies all highlighting an increase in supervision tasks, a lack of adequate resources (technical and spatial) and the impact of concomitant childcare responsibilities (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021; Bol, Derks, and Poorthuis, 2021; Corbera et al., 2020; Lopes, Coelho, and Ferreira, 2021; Royal Netherlands Academy of Arts and Sciences, 2022). Childcare, especially for children under the age of 12, has been highlighted by women as one of the elements that had the greatest impact on their workload, on the associated stress and, consequently, on their career (Ashencaen Crabtree, Esteves, and Hemingway, 2021; Górska et al., 2021; Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021; Parham and Rauf, 2020; Lopes, Coelho, and Ferreira, 2021).

The emotional impact associated with COVID-19 was significantly greater among women academics than among male academics, according to data from the SUPERA questionnaire. This contributed to a more marked deterioration in the mental health of women academics (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021).

Another stressor discussed in the previous sub-chapters was the dissolution of boundaries between professional and personal space, with a clear impact on work-life balance (Yüceol et al., 2021; Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021; Chung, 2022; Parham and Rauf, 2020; Susilaningsih et al., 2021; Ilić-Kosanović, 2021). Analysis by (Bilge, Alkan, and Ağanoğlu, 2020) has highlighted the difficulty of separating work and personal life as one of the most important stressors for both men and women, but with a slightly higher percentage for women.

Finally, social isolation is another recurrent element reported more often by women academics. **Women academics have identified lack of contact with peers, isolation from family and friends, and lack of time for leisure and self-care due to an increased workload as a major distorting element of their mental health** (Ashencaen Crabtree, Esteves, and Hemingway, 2021; Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021; Parham and Rauf, 2020; Bilge, Alkan, and Ağanoğlu, 2020). Moreover, this feeling of isolation affected more vulnerable groups, such as young researchers, single-parent or single households (Gao and Sai, 2020).

This negative impact on mental health and work-life balance has predominantly been reported for academics with stable contracts. However, it has also been a negative element for the mental health of postdocs and ECRs (Rosa, 2022). Morin et al. point out that 76% of the participants in their study reported a strong

impact of COVID-19 on their mental health, with a higher incidence in women and other groups considered vulnerable (e.g. LGTBIQ+, ethnic minorities) due to a greater burden of care (Morin, A. et al., 2021). In a study by Naumann et al. (Naumann et al., 2022) on the mental health of ECRs in Germany with a sample of 222 PhD candidates, 76% of the participants in the study reported a **deterioration in their mental health during and after lockdown, highlighting work-life balance, career prospects and the working environment as the aspects worst perceived by ECRs**. Finally, students have also reported a significant impact of COVID-19 on their mental health and stress, mainly due to the transformation of teaching to the online space (Zalite and Zvirbule, 2020). At the University of Oxford, this impact was also reflected in the increased demand for student counselling and support services (University of Oxford, 2022).

In addition to the psychological and emotional impact, COVID-19 negatively impacted the physical health and wellbeing of academics. This impact was due to reduced movement and physical exercise, poor ergonomic and spatial working conditions and reduced access to open space and fresh air, especially during lockdown (Yüceol et al., 2021; Parham and Rauf, 2020).

3.5.3. Main Challenges

Based on the above, we can identify some of the most significant challenges for work-life balance and wellbeing from COVID-19. Among the most significant are:

- Need for more research on the impact of COVID-19 on work-life balance, both quantitative and qualitative (Palumbo, 2020).

- Gender biases in the conceptualisation of work-life balance linked to normative traditional family model and gender roles. Work-life balance is relevant for wellbeing beyond the care duties and values linked to traditional family and gender roles (Rosa, 2022).

- Dissolution of the boundaries between personal and professional space, giving rise to work-life conflict and thus worsening the wellbeing of academics (Ilić-Kosanović, 2021).

- From flexibility to fluidity: difficulty in disconnecting from work obligations increased by the immediacy imposed by new technologies (Parham and Rauf, 2020).

- Prioritisation of teaching tasks due to the need to respond to the training needs of the student body, which are also more time-consuming because they have to be adapted to the online format (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021).

- Consequent increase in the workload in order to cover teaching tasks and maintain research activity, as well as the emergence of new tasks, such as accompanying and mentoring students to prevent them from becoming demotivated (Ashencaen Crabtree, Esteves, and Hemingway, 2021; Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021);

- The deterioration of working conditions due to the lack of technical, spatial and care facilities. (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021).

- Loss of spaces for socialising and sharing with peers and colleagues - deterioration of mental health (Yüceol et al., 2021).

- Increased stress and pressure (Ilić-Kosanović, 2021).

Nevertheless, the analysis also reveals some opportunities for improving the work-life balance and wellbeing of academic staff, specifically of women academics:

- Time saved by not having to move around (Ashencaen Crabtree, Esteves, and Hemingway, 2021, p.1184);

- Flexibility to combine work and family (Athanasiadou and Theriou, 2021; Yüceol et al., 2021);

- Saving institutional costs (Ashencaen Crabtree, Esteves, and Hemingway, 2021, p.1182);

- Creation of new working spaces (second homes in the countryside/seaside) (Ashencaen Crabtree, Esteves, and Hemingway, 2021);

- Promotion of more sustainable and environmentally-friendly academic systems that avoid unnecessary travelling and commuting and make use of new technologies to improve work-life balance (Ashencaen Crabtree, Esteves, and Hemingway, 2021).

3.5.4. Existing Policy Practices

A guide developed by Spain's Network of Equality Units for University Excellence (Red de Unidades de Igualdad de Género para la Excelencia Universitaria, 2023) aims to mitigate the adverse effects of COVID-19 on equality and to manage better the risks arising from a context of uncertainty. The guide offers a list of good practices universities and other public institutions should adopt, which are designed to contribute to excellence in teaching, research, and management, and to promote responsible work-life balance and teleworking processes in pandemic contexts. Although the guide is mainly oriented towards good practice in universities, it also assumes co-responsibility on the part of those who make up the broader university community (families and social environment, as well as public administrations at state, regional and local levels) and therefore also provides suggestions for these key stakeholders.

We can also find inspiration from the literature. Corbera et al. (2020) provide recommendations for renewed academic practice in crisis, detailing what tasks need to be implemented, how they could be performed and who should be engaged in each.

Table 3. Guidelines for renewed academic practice during and post-crisis. Source: Corbera et al. (2020, p.196)

What	How	Who
Tasks and priorities	Prioritize personal and collective wellbeing over "productivity" focused tasks, recognize the diversity of needs, experiences, and vulnerabilities during the crisis, and question overall "rat race" practices.	Faculty, Administrators
Inequalities	Reflect on how the COVID-19 crisis is widening gender, ethnic and class inequalities and acknowledge them openly and collectively. Act upon inequalities in academic institutional environments through additional recognition and funding and technical support to vulnerable groups at all academic levels.	All members of the academic community
Emergency support	Redirect funding originally earmarked for non-essential travel and other non-core costs to cover student, postdoctoral, and adjunct faculty emergencies and other practices focusing on well-being and direct support to more vulnerable groups	Administrators and Faculty
Remote teleworking	During the crisis, organize meetings that focus on care and support in addition to "business-focused" meetings. After the crisis, increase use of tele-working and tele-conferencing option when logistically feasible, while respecting participants' constraints (parent care, childcare). Aim for parsimonious and efficient academic task management and avoid the over-scheduling of tele-conferences.	University administrators and Faculty
Remote teaching	During the crisis, consider the many differences and inequalities among students and teachers in their ability to participate in remote teaching and learning, and adjust participation and evaluation criteria accordingly.	Administrators and Instructors
Research practices	Establish new practices for data collection and dataset sharing as well as overall collaborative research and writing. Consider and minimize environmental impacts.	All Researchers
Dissemination	Consider moving yearly conferences and workshops to smaller online meetings every two years in order to cut on carbon emissions and allow for greater participation of low-income or/and geographically remote participants. Those online conferences/workshops could be spread through the year	Faculty, Administrators, and Meeting organizers
Productivity	Challenge productivity measures (i.e. number of academic papers, impact factors, citation indexes, and hypercompetitive funding) as the only priority evaluation criteria. Add (or push funders to add) evaluation criteria such as: direct support to medical or social emergency during crises; community or policy work related to social, economic, environmental, and political issues in crises; direct support to colleagues, students, and other university collectives during and in the aftermath of crises.	Administrators and Funders
Evaluation	During crisis, extend (or push to) timeline for faculty promotion, evaluation, and tenure by one year. Extend (or	Administrators and Funders

	push to) timeline for grant eligibility or assessment criteria by one semester or one year.	
Hiring	Prioritize (or push to) the creation of long-term academic position over short-term, adjunct faculty members and instructors. Increase pay compensations for adjunct teaching staff, including online teachers.	Administrators and Funders

3.5.5. Conclusion

The lockdown and crisis caused by COVID-19 had an undeniable gendered impact on the work-life balance and wellbeing of women academics and individuals with care responsibilities. This impact was directly related to the traditional distribution of caring roles and a traditional concept of the heteronormative nuclear family, which impacts the distribution of domestic work (at home and in academia). Care work is still shouldered mainly by women; however, this reality was frequently neglected in organisational responses to the pandemic. Moreover, the work-life balance and wellbeing of academics are also strongly conditioned by the system, which promotes constant competitiveness and encourages a productivity-based assessment of merit. This academic culture disadvantages women, gender-diverse individuals and academics experiencing multiple forms of discrimination, given their potentially limited access to the support systems needed to perform in accordance with these expectations.

There is evidence of a lack of institutional policies and measures having addressed the welfare of university and research centre staff during COVID-19. However, the papers analysed show that higher education institution (HEI) staff experienced strong individual, psychological and physical impacts because of COVID-19 and that this had a clear gender dimension.

In the European Research and Innovation context, it would be interesting to take advantage of the community of structural change projects to comprehensively analyse the measures implemented by the different projects and institutions involved, but above all, to analyse the structural dimension of COVID-19's impact on gender equality plans, as these are key to guaranteeing wellbeing and work-life balance.

3.6. Policy recommendations

Gender equality and gender mainstreaming have been a priority in the European Research Area (ERA) since 2012 (European Commission, Directorate General for Research and Innovation, 2020; European Commission, 2012). Among the three objectives defined to translate this political priority into practical issues and concrete actions, achieving gender equality in scientific careers at all levels is particularly relevant in the aftermath of COVID-19.

This commitment towards gender equality was reinforced in 2022 by introducing gender equality plans (GEPs) as an eligibility criterion for research organisations, public bodies and higher education institutes applying to Horizon Europe, the EU's Framework Programme for Research and Innovation (European Parliament and Council of the European Union, 2021). Among the thematic areas, which are

recommended to be included in these plans, are work-life balance and organisational culture, as well as measures to address gender-based violence, which can help the institutions improve their action plans in this area (European Commission, 2022). However, COVID-19 has introduced some elements expected to become a permanent part of everyday life in academic institutions and its impact should therefore be considered in the design of such a gender equality plan.

If the COVID-19 pandemic has shown anything, it is that **academic institutions were unprepared to deal with crises** such as the one generated by this disease. Even though there are new means and resources available to handle crises, especially thanks to technological development, **national governments, research institutions and HEIs need to be prepared and have action plans in place**. This crisis preparedness and management gap was particularly evident during the first wave. In a context where other crises are already looming, it is necessary to incorporate lessons learned from the impact of the COVID-19 crisis on institutions, and therefore we suggest:

As a general recommendation, we recommend that the European Commission and (regional or national) funding agencies:

- **Launch specific calls in upcoming Horizon Europe work programmes to promote research about the mid- and long-term effects of COVID-19 on the R&I sector.** Most of the research analysed provides partial and limited information about the impact of COVID-19, in terms of the scope, the approach and especially whether gender is analysed. More research is needed (both quantitative and qualitative) to enable the analysis of the mid- and long-term impact and the comparability of data. As the impact on women researchers is clear, research gathering and stressing women's voices and those of marginalized groups is needed, as is situated knowledge on those topics.

For 3.2 (care responsibilities), we recommend that:

the European Commission and (regional or national) funding agencies:

- **Draw attention to and acknowledge care work within education and research institutions.** Policy actors should encourage the recognition of care work within institutions, recognise it in promotion and advancement processes, and consider it in access to leadership positions.

- **Promote measures to retain women academics in science and prevent them from being left out of the system due to the impact of COVID-19.** Within the Horizon Europe programme, one of the elements introduced to achieve gender equality is the target of at least 50% women in expert groups and panels; however, COVID-19 has forced many women to leave their positions in academia to take up care work (Davis, Meagher, et al., 2022). Some of these women have not returned to their previous roles, and those who remain find it challenging to access expert groups and panels because of the hiatus caused by COVID-19. To achieve this goal, institutions must promote concrete actions and incentives for women to join these bodies

without adding to their physical and mental workload. In line with some of the recommendations from the literature (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021; Chung, 2022), they should encourage the review of KPIs and policies/cultures to avoid pressure and overwork.

- **Consider the impact of COVID-19 and lockdown on evaluations**, especially for those with care responsibilities **through corrective measures**.

- **Support extra grants or include specific measures in calls for proposals to boost the participation of candidates with care responsibilities**.

Universities:

- **Implement institutional policies** that foster co-responsibility in the workplace, taking into account gendered patterns of labour division outside of work (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021; Chung, 2022);

- **Consider the impact of COVID-19 and lockdowns on evaluations and promotions**, especially for those with care responsibilities through corrective measures (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021);

- **Include specific sections in Gender Equality Plans that contribute to the reduction of structural inequalities and that can help reduce the gender impact of future crises** through, for example, the promotion of co-responsibility and equal distribution of care tasks, training staff in technological and methodological skills, and defining work-life balance policies that establish clear barriers between the personal and professional spheres.

- **Incorporate a *COVID-19 Disruptions* statement in tenure and promotion files** with explicit instructions for external reviewers and internal review committees to consider inequalities generated by COVID-19.

For 3.3 (new working modalities), we recommend that:

The European Commission:

- **Develop legislation on telework and smart working as a guaranteed work option**, supporting individual agreements and recognising the right to digital disconnection (Chung, 2022).

The European Commisssion and (regional ornational) funding agencies:

- **Systematically collect and analyse qualitative and qualitative data, specifically about the R&I sector.** Data on the impact of COVID-19 on the sector is scarce and mainly not focused on the R&I workforce. Gender aspects should be systematically addressed.

Universities:

- **Regulate and ensure smart working as a permanent option** supporting individual agreements recognising the right to digital disconnection (Chung, 2022).

- **Incorporate into institutional policies the pandemic-related institutional changes that have improved academic life and contributed to alleviating the climate crisis**. The COVID-19 crisis also showed flexibility in working time management, timesaving for non-commuting or travelling, and the possibility of work/life balance.

For 3.4 (gender-based violence), we recommend that:

The European Commission and Member States:

- **Develop an EU baseline for a zero tolerance approach on gender-based violence in academia**, in line with the ERA Policy Agenda Action 5, taking into account online forms of sexual harassment and new working modalities.

The European Commission and (regional or national) funding agencies:

- **Support gender-based violence (GBV) evaluation** efforts using climate surveys to assess the prevalence of sexual harassment experiences among R&I staff by applying an intersectional approach.

Universities:

- **Use climate surveys to assess the prevalence of sexual harassment experiences among R&I staff**, applying an intersectional approach based on voluntary self-identification in the survey.

- **Address online forms of gender-based violence, including sexual harassment, in Gender Equality Plans,** for instance by considering this in the institutions' code of conducts, complaints protocol or support mechanisms for affected staff and students.

For 3.5 (work-life balance and mental health), we recommend that:

Member States:

- **Involve gender experts when designing crisis management plans**. All crises have an undeniable gender impact, so plans to prepare for future crises must involve experts who can incorporate gender expertise. As stated by the EU-funded project RESISTIRE ([1]) to develop the capacity of European HEIs to respond to future crises without increasing existing inequalities or creating

[1] https://resistire-project.eu/recommendations/

new ones, there is an urgent need to develop comprehensive, inclusive, multi-actor crisis management plans that build on intersectional approaches.

The European Commission and regional and national funding agencies:

- **Regulate new working arrangements so that flexibilisation benefits work-life balance** while protecting the barriers between personal and family life.

- **Rethink the notion of excellence and the promotion of a sustainable academic environment** that helps care for the academic staff, in line with ERA Policy Agenda Action 3 on reforming the research assessment system (European Commission, Directorate General for Research and Innovation, 2021).

Universities:

- **Consider care and sustainability alongside productivity and impact** in the development of future concepts of excellence in academia (Bustelo, De Dios Ruiz, and Pajares Sánchez, 2021; Chung, 2022).

- **Design and support actions for work-life balance to be integrated in Gender Equality Plans,** including staff profiles not linked to the traditional nuclear family (e.g. single-parent families and young researchers).

- **Establish and guarantee telematic services for psychological, emotional, and technical support**.

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4. Towards inclusive gender equality in the ERA: unseen and marginalised experiences of the COVID-19 pandemic in R&I

Clare Wenham
London School of Economics and Political Science (United Kingdom)

Sabine Oertelt-Prigione
Radboud University Medical Center (the Netherlands) and
Bielefeld University (Germany)

Thus far, this report has sought to highlight the gendered impact of the COVID-19 pandemic on those working in the research and innovation (R&I) sector. Through analysis of the unpaid/domestic care burden, the academic productivity burden, the impact on early career researchers, gender-based violence, work-life balance and mental health, this report has demonstrated the wide-reaching effects researchers have experienced since the start of 2020 that have disproportionately affected women. However, this is only part of the story. Intersectional analysis demonstrates that there are likely to be additional or supplementary axes of marginalisation in the research and innovation field (Holzleitner, 2005; Verloo, 2006). The present chapter builds on the priorities defined under Action 5 of the *ERA Policy agenda 2022-2024* and *Approaches to inclusive gender equality in research and innovation* (European Commission, Directorate General for Research and Innovation, 2021), which have started to highlight inclusiveness and intersectional needs across the sector. Given the situation described in the previous chapters, we expect these needs to have been aggravated by the pandemic.

In this fourth chapter, we have sought to compile the available literature on additional areas of concern for future policy in research and innovation. This current analysis is neither comprehensive nor conclusive, but it aims to point out the major aspects that need to be addressed in the future. Furthermore, the brevity of this section underlines the lack of systematic research on the intersectional impacts of COVID-19 on the research and innovation sector. This in and of itself indicates a clear need for further research on these intersectional impacts for enhanced policymaking.

Some research councils have sought to identify and quantify the impacts of COVID-19 along intersectional lines. However, most of this research has been conducted in Anglo-American countries, and limited evidence is available from continental Europe. AdvanceHE UK researched the intersectional impacts of COVID-19 on higher education and collected survey data on remote working and

its enabling benefits and barriers. The institution was able to disaggregate these data by disability, ethnicity, age and gender (Aldercotte et al., 2021). Overall, women reported more opportunities to attend conferences and engage in career development activities through remote working, while men experienced more opportunities for research and teaching. Individuals with a Black, Asian or minority ethnic background reported more research and career development opportunities than their white colleagues. Researchers with disabilities described more administrative and career development options than their colleagues without disabilities. The Canadian Institute of Health Research (CIHR) researched the COVID-19 gender policy changes introduced to support women scientists and improve research quality. Such policy changes (described in chapter 1) included compensation for dependent caregiver costs, extending early career status, doubling parental leave credits, and allowing for pandemic impact statements to be included in grant applications. However, this evaluation noted that "*barriers related to other identity dimensions (race, ethnicity, indigenous identity, disability) require further analysis and consultation to identify solutions*" (Witteman, Haverfield, and Tannenbaum, 2021). Thus, these were not accounted for in their evaluation.

The following sections list essential information needed for future targeted interventions.

4.1. Care beyond children

Throughout the COVID-19 pandemic, the unpaid care burden was exacerbated for all. This has been widely researched and is highlighted in Chapter 3, demonstrating the gendered nature of this care burden relating to children and its ramifications across the R&I sector. However, care responsibilities extend beyond children, a factor which has not been examined enough to date. This includes care for, e.g. senior citizens, family members with complex needs, partners and chosen family members beyond traditional heteronormative nuclear families, and community members and neighbours. This may not be as visible as childcare responsibilities, but it still had gendered effects across the research landscape. During the pandemic, formal support for older people and people with dementia was restricted, leading to increased anxiety and distress and a worse quality of life for those in need of care (Giebel et al., 2021). Most studies have highlighted how informal carers for disabled, sick or elderly relatives appeared to experience an increased burden of care work during the pandemic with repercussions for their mental health (Bergmann and Wagner, 2021; Budnick et al., 2021; Park, 2021; Hughes, Liu, and Baumbach, 2021). A few studies could not confirm these trends, yet they still identified a significant increase in overall caregiver strain in the last decades, which was marginally exacerbated by the pandemic (Schluter et al., 2022). Interestingly, one study using a large Austrian dataset could not find a difference in the care burden overall before and during the pandemic but identified a gendered difference in impact. Men caregivers appeared to experience a greater psychological burden than women caregivers (Rodrigues et al., 2021). It should be noted that these studies did not specifically address the situation of informal carers employed in the research and innovation field, but trends in the general population.

Spain introduced policies "*to keep a balance between work and family responsibilities (Primary Care) by allowing a reduction of working hours for employees who had to take care of family members due to COVID-19. Some regional governments provided economic compensation for the loss of income*" (Živković and Lionello, 2022). One example of a research organisation doing the same was ETH Zurich, which "*treated the additional time employees spend caring for children or relatives as normal working hours*" (Standing Working Group on Gender in Research and Innovation, 2020). A 2021 OECD (Organization for Economic Cooperation and Development) report summarised many of the efforts of Western countries during the acute and recovery phase of the pandemic and offered recommendations for the future. However, a broad and inclusive definition of families is missing in the report and care work is almost exclusively framed as childcare, thus limiting the applicability of the proposed interventions (OECD, 2021).

4.2. Researchers with a disability

Prior to the pandemic, there still existed legal, policy and implementation gaps to protect workers with disabilities further. Several efforts are ongoing within the R&I sector to bring greater inclusion and provide practical mechanisms to support those living with disabilities. For example, the French Ministry for Higher Education, Research and Innovation offers the 'Doctorat Handicap' (Ministère de l'Enseignement Supérieur et de la Recherche, 2022) scheme to support students with a disability to pursue doctoral studies, while the Austrian Science Fund promotes inclusive funding procedures, by allowing applicants to justify career breaks or non-linear careers, due to a disability, chronic illness or care responsibilities in their academic CV (Austrian Science Fund, 2023).

Given the restrictions on mobility, many assumed that COVID-19 might bring greater opportunity to those workers with a disability if physical presence was not required. As noted above, in the AdvanceHE UK study, staff reporting one or more disabilities stated that remote working had facilitated their engagement with administrative work and career development opportunities compared with non-disabled respondents (Aldercotte et al., 2021). Whilst this may have been the case for some, it aggravated or increased other barriers to participation for others. Hwang et al. (2022) demonstrated that for those with intellectual or developmental disabilities, online participation in the workplace was a challenge. However, it also showed promise regarding the types of task-oriented activities for research teams that could be conducted online. At the same time, focused research has demonstrated that those people with complex health needs (e.g. hypertension, diabetes, musculoskeletal disorders, depression) had greater stress levels during the pandemic (Anwer et al., 2021).

A qualitative study from the United States investigated the impact of the potentially conflicting demands of the role of scholar and mother in women and gender-diverse people with disabilities. The scholars pointed out how the pandemic exacerbated many of their pre-existing medical issues due to increased demands and limited resources and forced them into a difficult reconciliation process between their different identities (Wagner et al., 2022). Disabilities could reduce a researcher's ability to perform compared to academics without disabilities in pre-pandemic times. However, a reduction in services, access and

support during the pandemic could exacerbate these differences. A landmark case in Australia highlighted these systemic issues in May 2020. Professor Justin Yerbury, who is affected by motor neuron disease, was not awarded a research grant on the grounds of reduced research output compared to his non-disabled peers. During the evaluation process of his research proposal, disability was not explicitly considered, effectively leading to his being discriminated against. He successfully appealed the decision, and the case led to an adjustment in the review policies of the Australian National Health and Medical Research Council (NHMRC), which now explicitly considers disability as a mitigating factor during assessment (Nature News, 2021).

The National Association of Disabled Staff Networks (NADSN), an umbrella organisation in the UK, published an overview and recommendations to address the specific needs of disabled workers in the higher education system. The paper specifically addresses the need to maintain "no-detriment" policies throughout, guaranteeing that respect for disabled workers´ needs cannot imply disadvantages, such as, e.g. negative consequences due to the inability to give lectures on-site or increased expenses due to necessary adaptation for a work station at home. The publication ends with twelve explicit recommendations spanning the need for equality impact assessments focused on disability, questions of access and disclosure, to the need for impact assessments of the pandemic on the scientific output of scholars with disabilities (Brown et al., 2021).

4.3. LGBTIQ realities

As demonstrated in Chapter 3, women disproportionately shouldered the burden of unpaid care during the pandemic, particularly childcare needs. Whilst there was progress in some locations to ensure support for women when needed and to support those who had to leave paid employment to take care of children, these policies were mostly targeted towards cis-women in nuclear dual-parent families. Little research was conducted to understand the impact of the pandemic on LGBTIQ[2] realities, and little policy was available to become more inclusive of the diverse population. Data collection issues are intrinsically linked to the issue of academic visibility of LGBT+ scholars, a problem that predates the pandemic (Reggiani, Gagnon, and Lunn, 2023). Overall, the pandemic significantly impacted the lives of LGBTQ people, exacerbating pre-existing vulnerabilities and inequalities (Salerno, Williams, and Gattamorta, 2020). One scoping study in the UK revealed that the lack of research on LGBT+ individuals was of concern as it might mask the myriad of impacts experienced by these marginalised groups. As is already well known in the literature, social and structural factors often led to poorer health outcomes in this group before COVID-19. However, such data is sometimes difficult to obtain, given the lack of sexual orientation or gender identity data (McGowan, Lowther, and Meads, 2021). While some surveys in the

[2] Definition according to the European Commission's LGBTIQ Equality Strategy 2020 – 2025: LGBTIQ people are people: – who are attracted to others of their own gender (lesbian, gay) or any gender (bisexual); – whose gender identity and/or expression does not correspond to the sex they were assigned at birth (trans, non-binary); – who are born with sex characteristics that do not fit the typical definition of male or female (intersex); and –whose identity does not fit into a binary classification of sexuality and/or gender (queer).

United States have addressed the impact of the pandemic on the experience of students (Gonzales et al., 2020) and younger individuals in general (Kamal et al., 2021; The Trevor Project, 2021), very little is known about the impact on researchers and lecturers. A 2020 two-round Canadian survey including more than 6 000 participants from the general population compared the health of sex and gender-minority (SGM) adults and non-SGM Adults. The survey demonstrated how mental health deteriorated significantly in the SGM group, sometimes leading to suicidal ideation; in addition, substance use increased in this population compared to the non-SGM group (Slemon et al., 2022).

The systematic investigation of a focus on LGBTQ realities in surveys of the academic workforce has long been neglected and is still a contentious issue (Langin, 2020). In R&I, using workforce data for some university institutions, it was demonstrated that LGBTQ individuals were more likely to report harassment and social isolation than heterosexual colleagues (Cech and Waidzunas, 2021), were less likely to find career development opportunities and more likely to have had their professional expertise devalued by peers. Consequently, LGBTQ professionals are more likely to say they are considering leaving their careers in STEM sectors (Cech and Waidzunas, 2021). However, firms that nurture LGBT-supportive policies are more innovative across the R&D sector (Kyaw, Treepongkaruna, and Jiraporn, 2021).

Despite this evidence of the role of LGBTIQ individuals in the R&I sector, there has been little to no research considering the impact of the pandemic on this subset of the workforce. This is a clear omission which needs to be better understood for enhanced policies to be introduced.

4.4. Researchers with an ethnic minority background

Over the last two decades, significant research has demonstrated the historically more stringent barriers that ethnic minority researchers have faced in the R&I sector overall. At the time of writing, minimal research had been conducted to understand the intersectional racial impact of COVID-19 amongst early career researchers in university institutions. Women of colour in the United States consistently stated that COVID-19 had impacted their research productivity, primarily due to the impact of unpaid care within the home, including home-schooling (White et al., 2022). However, in the UK, Black, Asian and ethnic minority employees in higher education were more likely to state that home working enabled engagement with research and career development activities than white respondents (Aldercotte et al., 2021).

Given the widespread evidence that Black, Asian, and ethnic minority communities were disproportionately impacted by the direct and indirect effects of the pandemic, with a higher burden of infection, mortality, and morbidity, it is likely that this might have manifested itself in secondary effects on ethnic minority colleagues. Verdery et al. (2020) published a bereavement calculator for the US, which allowed a breakdown of the potential consequences of every COVID-19 death for the kin of the affected person. The authors demonstrated how the higher incidence and the more extensive kin networks in Black Americans would lead to a significantly higher grief burden than in white Americans, given the overall higher mortality rates among Black communities in the US (Vasquez

Reyes, 2020). This trend also applied to the UK (Office for National Statistics, 2023). Although the data were not broken down by occupation, we can extrapolate how Black academics might have been more impacted by loss, grief, and bereavement due to the pandemic than their white colleagues. Njoku and Evans have provided a striking summary of the situation faced by Black women academics in the US. They detail how Black academics experienced particular challenges navigating the intersecting requests from work and home while navigating systemic racism and police brutality, loss of loved ones and grief (Njoku and Evans, 2022).

Similar research is not available for the EU. In some cases, intersectional approaches might have been neglected. However, we also note that such research may not be feasible in some European countries where collecting race or ethnicity data is not legally possible. Overall, the lack of data on the intersection of racialised and gender-based discrimination hampers the development of targeted support for the most vulnerable groups in academia.

4.5. Concluding thoughts

In addition to the forms of discrimination enumerated, there may be a range of others for those working in R&I, which the pandemic has exacerbated. However, rigorous research has yet to be conducted. For example, this might include ageism (World Health Organization, 2021), discrimination against indigenous groups or the Roma community, or other axes of marginalisation. This chapter highlights that we do not have the necessary information about all the differential and disproportionate effects that different marginalised groups might have experienced during or as a result of the pandemic and how these may impact short-, medium- and long-term participation in the R&I sector. Consequently, it is also challenging to currently propose evidence-based intersectionality-informed recommendations to address these inequities. This gap must be kept at the front of policymakers' minds as they embark on reforms to the sector.

Some general recommendations should be considered for future rectification efforts:

- The current lack of data highlights the issue of visibility. Visibility is a critical issue but also a contested one. Identifying with a group that experiences discrimination places these individuals at risk of further stigmatisation or discrimination. Being visible should not be an act of bravery that individual researchers have to face – it should be an organisation´s duty to guarantee personal safety and prevention of any form of discrimination to allow individuals to express themselves at work in the R&I field safely.

- Invisibility correlates with a lack of data - if certain groups are not "seen" in the R&I system, no data will be collected about their access and participation, or lack thereof. The collection of intersectional information should be the standard, especially in areas where discrimination can affect diverse groups in different ways. Inequalities in access and progression can structurally characterise academia and are aggravated in a crisis. Hence, intersectional data should be collected regularly to allow for the rapid and reliable identification of possible exacerbations. For example, at the institutional level, universities and other research performing organisations may seek to collect

equality data based on voluntary, anonymous self-identification, in line with GDPR requirements (Lipinsky et al., 2021).

- As the limited amount of available data shows, the pandemic has affected researchers in different ways based on their gender identity, care responsibilities, age, ethnicity/race, their (dis)ability, etc. Mitigation measures need to consider these differences to offer the most disadvantaged groups the appropriate support. These efforts can range from targeted awareness-raising campaigns to the inclusion of intersectional aspects in applications for research grants and promotions or specific support schemes. Intersectional data should inform the definition of disadvantage and the development of targeted responses going forward.

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5. Members of the Expert Group

The Commission Expert Group on the COVID-19 impact on gender equality in Research and Innovation (E03817) (European Commission, n.d) was created in December 2021. It kicked off its activities in March 2022, followed by several virtual meetings and a hybrid workshop with R&I stakeholders in Brussels in October 2022.

5.1. List of contracted experts

Role in expert group	Name and affiliation	Country
Chair	**Sabine Oertelt-Prigione** Radboud University Medical Center and Bielefeld University	DE
Rapporteur	**Jens Peter Andersen** Aarhus University	DK
Thematic area 1: academic productivity, practices, and institutional responses	**Flaminio Squazzoni** (*Lead*) University of Milan	IT
	Liisa Husu Hanken School of Economics and Örebro University	FI
	María López Belloso University of Deusto	
Thematic area 2: Early career researchers	**Marc J. Lerchenmueller** (*Lead*) University of Mannheim and Leibniz Center for European Economic Research	DE
	Aliza Forman-Rabinovici Tel Aviv University and Occidental College	IL
	Thais França CIES-Iscte, Instituto Universitário de Lisboa	PT
Thematic area 3: Care, new working modalities, gender-based violence and work-life balance	**María López Belloso** *(Lead)* University of Deusto	ES
	Éva Fodor Central European University	HU
	Lucio Pisacane Italian National Research Council	IT

Thematic area 4: Intersectionality	**Clare Wenham** *(Lead)* London School of Economics and Political Science	UK
	Sabine Oertelt-Prigione Radboud University Medical Center and Bielefeld University	DE
Communication and copy-editing	**Marion Bywater** Bycon Associates	BE

5.2. References

European Commission (n.d), Register of Commission Expert Groups (https://ec.europa.eu/transparency/expert-groups-register/screen/expert-groups/consult?lang=en&groupID=3817)

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This report presents the findings of the European Commission's Expert Group on the COVID-19 impact on gender equality in Research and Innovation (R&I). The report highlights in particular the pandemic's gendered impact on academic productivity, early career researchers, and work-life balance. It investigates institutional responses and aims to bring forward unseen and marginalised experiences in academia. The recommendations are intended for R&I policymakers at national and EU-level, research funding organisations and research performing organisations. They present an opportunity for Member States and R&I organisations to apply the lessons learnt from the pandemic to the development of inclusive gender equality policies in the European Research Area (ERA).

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