



Australian Government

Chief Scientist

17 May 2020

The Hon Karen Andrews MP
Minister for Industry, Science and Technology
Parliament House
CANBERRA ACT 2600

Dear Minister

Please find attached a response to your request for an analysis of the available evidence to respond to your question:

What impact is the COVID-19 pandemic having on women in the science, technology, engineering and maths (STEM) workforce?

This rapid response has been prepared by the Rapid Research Information Forum that I Chair. The report synthesises the evidence base on this matter and has been informed by relevant experts and has been peer reviewed. Details of the authors and peer reviewers can be found in the Appendix.

I hope this document proves useful to you and your colleagues.

Yours sincerely,

A handwritten signature in purple ink, reading 'Alan Finkel'.

Dr Alan Finkel AO FAA FTSE FAHMS
Australia's Chief Scientist

17 May 2020

This rapid research information brief responds to the question: What impact is the COVID-19 pandemic having on women in the science, technology, engineering and maths (STEM) workforce?

- Women are a minority in STEM professions. Based on disparities in the distribution of domestic workloads and reduced career opportunities compared to men, this pandemic is expected to disproportionately hinder women's STEM careers.
- Early evidence on the impact of the epidemic suggests women face disproportionate increases in caring responsibilities and disruptions to working hours, job security and paid work capacity. This is most acute for those with children under 12.
- Job insecurity is emerging as an even more troubling issue for women in STEM than for men. High proportions of women employed in short-term contract and casual jobs are likely to be threatened by cuts to research and teaching jobs.
- Women from diverse backgrounds face additional barriers to entry, retention and progression in the STEM workforce. Anticipated COVID-related funding cuts to equity programs would set back gains in STEM workforce diversity.
- Evidence demonstrates the benefits of diverse research workforces and the risks of homogenous research workforces, highlighting the need to hold gains made by women in STEM in recent years.
- Hard-won gains by women in STEM are especially at risk. This risk will be even greater if STEM employers do not closely monitor and mitigate the gender impact of their decisions.

Evidence is still being gathered on the effects of the COVID-19 pandemic on women in the STEM workforce. There are early signs it will result in greater disadvantage for women than men in this sector.

The pandemic has shut down research facilities, laboratories, and other STEM workplaces – profoundly disrupting work patterns for researchers and practitioners in STEM. Further, parents of young children have been juggling STEM jobs from home while supervising education and care. The disruption is likely to be more severe for women than men, given their greater share of caring responsibilities and domestic work. The pandemic appears to be compounding pre-existing gender disparity; women are under-represented across the STEM workforce, and weighted in roles that are

typically less senior and less secure.¹ Job loss at a greater rate than for men is now an immediate threat for many women in Australia's STEM workforce, potentially reversing equity gains of recent years.

Pre-COVID context

In 2016, women comprised 29% of the labour force that had a university STEM qualification (and 8% of the labour force that had a VET STEM qualification).¹ There were around 7,500 women employed in STEM research fields in Australia in 2017, compared to around 18,400 men.² In the university workforce, women hold 47% of the casual jobs, and based on limited available data, a greater proportion of women than men are on fixed term contracts.³ Only 12% of academics at the professorial level are women, highlighting the promotion barriers and potential bias outlined in the Women in STEM Decadal Plan, with very small increases in biology, medical and environmental science in recent years.^{2,4} In the private sector, women represent one in four STEM-qualified professionals (27%).²

Pre-COVID, women were also under-represented in career-accelerating **research grants** funded by the Australian Government. In 2019, fewer than one in four applications for Australian Research Council STEM project grants were led by women (24%), while women represented 26% of funded lead investigators.² In 2018, fewer than one in three applications for National Health and Medical Research Council grants were led by women (28%), with women comprising one in four funded lead investigators (25%).²

COVID-19 workforce impact

Across the Australian economy, COVID-related **job losses** have been profound – between 650,000 and 700,000 jobs were lost between February and April 2020.⁵ Australia's professional, scientific and technical services industry recorded job losses of 5.6% from mid-March to mid-April 2020, with women hardest hit; jobs in this field were down 6.3% for women and 4.8% for men.⁶ Research sector STEM jobs are at ongoing risk because of income losses to universities and the flow-on effect to collaborating institutions.⁷ With casual and short-term contract jobs likely to be the first to go, women are at particular risk – with women 1.5 times more likely to be in insecure jobs in the overall university workforce.^{8,9} **Vulnerability to job losses** will vary from discipline to discipline. In mathematics, 64% of all women in academic positions are in casual jobs.¹⁰ Casual and fixed-term positions are the least secure, yet employ the most women. This precariousness of women's relative position in the STEM labour market is likely to be exacerbated by the pandemic.

Across the whole Australian labour force, paid work has fallen from around 35 to 31 hours per week on average since the hundredth diagnosed case of COVID-19 in Australia.⁵ Women’s average paid working hours fell by 4.43 hours a week – while men’s fell by 3.70 hours – and people from non-English speaking backgrounds lost 5.82 hours.⁵

Prior to COVID-19, women in heterosexual relationships shouldered a larger proportion than men of **domestic duties and caring responsibilities** for elders and young children (Table 1).^{11,12}

Table 1: Time spent on domestic activities and childcare by gender: Australian Bureau of Statistics¹³

ABS Time Use Data — 25-34 years		
	Female	Male
Time in paid work	22 hours / week	44 hours / week
Domestic duties and caring activities	21 hours / week	10 hour 30 mins / week
Breakdown of childcare as primary activity		
Age range: 0-4 years	30 hours / week	11 hours / week
Age range: 5-11 years	4 hours 15 mins / week	2 hours 38 mins / week
Age range: 12-14 years	1 hour 15 mins / week	1 hour / week

Research in the United States shows the COVID-19 stay-at-home measures have led to an increase in the hours of unpaid care work done by mothers compared to fathers, even where both parents work full-time.¹⁴

While COVID-19 work-from-home policies apply to men and women equally, anecdotal reports observe that women – typically those with children – bear the major burden of **home-schooling supervision, meal preparation and more general housework**, while also managing their paid workload.¹⁵

Research leaders in Australia and New Zealand observed that women led the early adaptation of university teaching to online, compounding pre-existing gender disparities in research and teaching roles.¹⁶⁻²² Women in the academic STEM workforce have previously faced **a disproportionate increase in workload to develop materials for online teaching** and taken on extra teaching to cover the loss of casual staff.¹⁶

Women also perform a greater proportion than men of service roles in academic STEM, including pastoral care and mentoring, which could be expected to increase in times of stress.²³⁻²⁵

The pandemic has rendered women less likely than men to attend some STEM workplaces (and therefore more likely to be working from home), such as the major university STEM (STEM plus

medicine) faculties represented in Table 2.²⁶ On the other hand, CSIRO found a generally closer proportion of men and women working from home, at the workplace, or at both locations (Table 3).²⁷

Table 2: Female and male staff visiting campus in a two month COVID-19 period by STEMM faculty, n = 674²⁶

16% of female staff visited campus across three STEMM faculties, compared to 28% of males.
In the Faculty of Science, 23% of female staff visited the faculty, compared to 30% of males.
In the Faculty of Medicine, 10% of female staff visited the faculty, compared to 15% of males.
In the Faculty of Engineering, 23% of female staff visited the faculty, compared to 34% of males.

Table 3: STEMM employees' working locations by gender (20-27 April) – CSIRO, n = 1079²⁷

STEMM employees working locations by gender – national research organisation		
	Female	Male
Normal work site	9%	11%
Part work / part home	30.5%	25%
Fully from home	60.5%	64%

Academic output

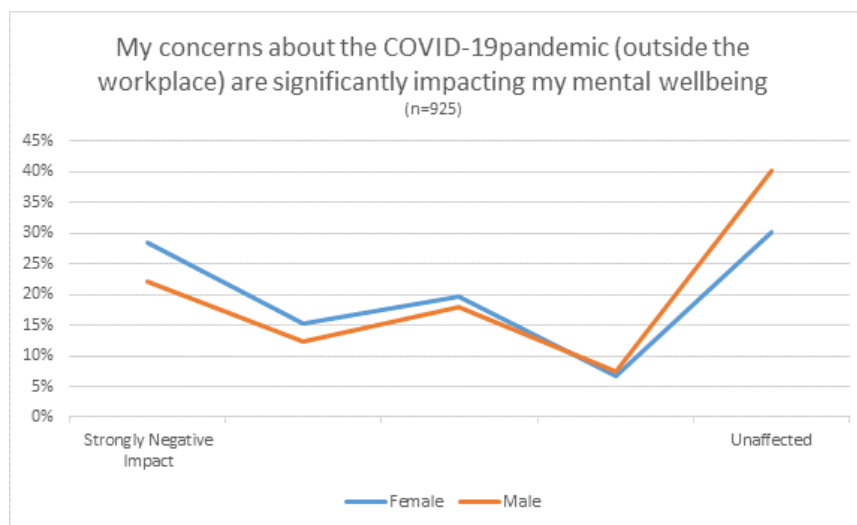
Prior to COVID-19, women and men conducting academic research in STEM produced comparable numbers of research publications per working year (although women published fewer papers over their entire careers due to career disruptions).²⁸ Early evidence suggests women's **submission rates may have declined** during the pandemic while men's submission rates have increased – reflecting similar trends when men take paid parental leave.^{29–31} More data is expected in the near future. As the number and quality of peer-reviewed papers a researcher publishes are factors in awarding research funding and academic promotion, a reduction in the quality or quantity of women's research publications is likely to harm job and funding prospects now and for years to come. Statistics for 2020 grant applications are not yet available in Australia.

In **international trends**, early evidence from New Zealand suggests mothers in STEM have missed funding application deadlines and postponed manuscripts, sabbaticals and fellowships during COVID-19.^{17–22}

Wellbeing is also being affected. While anxiety across the Australian population has risen, ABS data show a greater rise for women than men.³²

A staff survey at CSIRO in April 2020 found that among staff aged under 25, one in two women reported some or moderate feelings of being anxious or worried, compared to one in three men.²⁷ For 25-44 year olds, two in five felt anxious or worried – with broadly similar results for men and women.²⁷ An ANSTO staff survey found pandemic-related factors outside ‘work arrangements’ had a greater negative impact on women than men.³³ This may be linked to women’s greater carer responsibilities.¹³

Graph: Staff concerns (outside the workplace) by gender during the pandemic – ANSTO, n = 925³³



Women are significantly more likely than men to experience violence in their own home.³⁴ Early statistics indicate **domestic violence rates** have risen during the COVID-19 shut-down.³⁵ In the week 27 March to 2 April 2020, crisis services noted client numbers rose significantly, client needs were more complex, and violence more severe.³⁵ People subjected to domestic violence have poorer mental health and are much less likely to be able to hold down a job or progress in a career.³⁶

For **tech entrepreneurs and startups**, 2019 research found no female-founder CEO in the survey had raised more than \$3 million, yet male-founded startups had raised up to \$50 million.^{37,38} Women’s extra COVID-related domestic burden is likely to exacerbate the challenges for women seeking to raise capital. The new Australian Government initiative, Boosting Female Founders, may help alleviate some of these challenges.³⁹

Currently, there is insufficient research to conclude whether women in STEM from culturally and linguistically **diverse backgrounds**, Aboriginal and Torres Strait Islander women, women with disability, and women who identify as LGBTIQ+ – who faced pre-COVID additional barriers to entry, retention and progression – have experienced further specific challenges as a result of the pandemic.

Indigenous people are less likely to be employed in professional, scientific and technical services than non-Indigenous people (2% compared to 7%), and early analysis suggests the pandemic risks exacerbating longstanding inequities for Indigenous Australians.^{40,41}

Post COVID-19 implications

Given the compounding effect of **career breaks and gender-based discrimination** on career progression, it is reasonable to assume the pandemic is likely to have more long-term negative implications for women in STEM than men. This is also the conclusion of a major US and German study which finds the effects on women are disproportionate to men and are “likely to outlast the actual epidemic”.⁴²

Much work has been done in recent years to redress the gender imbalance in STEM, but the Science in Australia Gender Equity (SAGE) program reports there is a danger this work may slow down or, according to some institutions, begin to reverse.⁴³ As SAGE requires participating institutions to collect data on workforce indigeneity and intersectionality more broadly, and to design programs that apply intersectional approaches, any COVID-related cuts to institutional SAGE programs would also set back broader gains in STEM workforce diversity.

The 2019 Women in STEM Decadal Plan outlines a path to achieve gender equity by 2030, including detailed strategic recommendations. While the pandemic may present an additional obstacle, its recommendations remain highly relevant.

Mounting evidence demonstrates the benefits of diverse research workforces and the risks of homogeneous research workforces – including examples of technology and treatments designed for male users or patients that do not work as well for women.^{44,45} Long-term implications of the COVID-19 pandemic for the Australian research workforce as a whole are serious, as clearly defined in a previous RRIF paper.⁷ Current and future **women in STEM are particularly at risk** if important advances of recent years wind back.⁴⁶ This potential danger will grow if STEM employers do not closely monitor and mitigate the gender impact of their decisions.

An important note on available COVID-19 research

The rapidly changing picture and the relatively short timeframe of the outbreak mean conclusions drawn in early research need to be interpreted with caution. Pre-prints are marked with a § in the reference list. This brief is accurate at the time of writing and may become out of date at a later time of reading. Science & Technology Australia and the Australian Academy of Technology and Engineering invite readers to seek subsequent updates.

APPENDIX

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RAPID RESEARCH INFORMATION FORUM

The impact of COVID-19 on women in the STEM workforce

The Rapid Research Information Forum (RRIF) is a forum for rapid information sharing and collaboration within the Australian research and innovation sector. It is convened by Australia's Chief Scientist, Dr Alan Finkel AO FTSE FAA FAHMS, and its operations are led by the Australian Academy of Science.

RRIF provides a mechanism to rapidly bring together relevant multidisciplinary research expertise to address pressing questions about Australia's response to COVID-19, as they emerge.

RRIF enables timely responses to be provided to governments based on the best available evidence. RRIF also informs the Chief Scientist's interactions and collaboration with other national chief scientific advisers. It demonstrates the critical value of research and innovation in driving societal as well as economic progress now and into the future.

Forum member organisations

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- Royal Society Te Apārangi (New Zealand)
- Australian Council of Learned Academies (ACOLA)
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