

Executive Summary

Assessing the Impact of COVID-19 on STEM (Science, Technology, Engineering, Mathematics) Researchers in India*

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Executive Summary

Introduction / Context

The outbreak of the COVID-19 pandemic and the nationally mandated social distancing led to unexpected roadblocks for academics with regards to permitted research operations, abiding to social distancing guidelines in the laboratory, facility closure, decreased laboratory activities, and shifting to remote working (Termini & Traver, 2020). The pandemic has changed the way one conducts research affecting those who lack digital literacy or access to different technologies and research tools (Mitchell, 2021).

Early career researchers (ECRs), including PhD students and postdoctoral fellows, are affected at the most crucial time in their career development (Cheng & Song, 2020) in terms of research productivity, timeline of conducting experiments and research studies, insufficient funding, and connecting with different scientists (Termini & Traver, 2020). However, graduate students' reported receiving more support from their advisors, professors, and peers (Ogilvie et al., 2020). Those having lesser social support networks tended to struggle with their mental well-being (Byrom, 2020). Hence, COVID-19 has had a significant impact on mental health and productivity of scientists (EMCR Forum, 2020).

Although the entire scientific community was affected, women academics faced unequal work-life balance leading to a reduction in the time spent on research as compared to men during the pandemic (Deryugina et al., 2021). Apart from gender, studies also highlight the presence of racism against black women in academia (Staniscuaski et al., 2021). Furthermore, in India, it has been noted that Brahmins and other dominant castes dominate in academic professions (Thomas, 2020).

Studies have explored how researchers in STEM fields have been coping with changes in routines, funding, and the like in the wake of the pandemic, using international samples (Myers et al., 2020). The current study's purpose was to comprehensively understand the effects of the COVID-19 pandemic on STEM scientists and stakeholders across India while focusing on the gender and caste of researchers.

Methodology

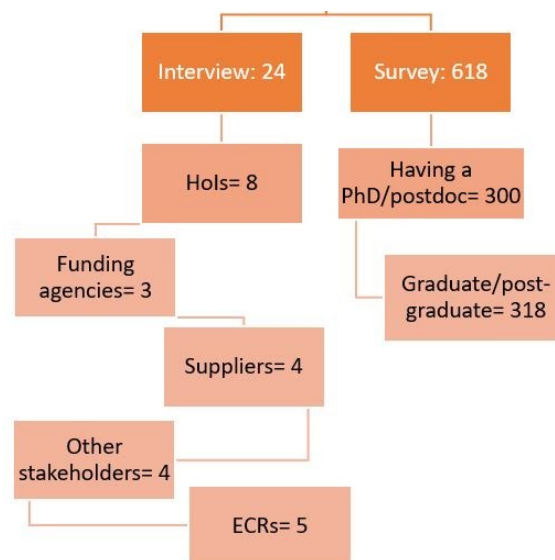
Employing a mixed method design, the current research used both quantitative (survey) and qualitative (interview) methods to understand the impact of the pandemic on STEM ECRs, Heads of Institutes, suppliers, funders, and other stakeholders. To make the survey more accessible to participants, it was made available in ten Indian regional languages (Hindi: 75, Marathi: 24, Tamil: 13, Kannada: 6, Telugu: 1, Bengali: 18, Gujarati: 7, Malayalam: 11, Oriya: 3, and Assamese: 4) along with English (n = 912).

The self-developed survey included questions related to participant's socio-demographics, research issues faced due to the pandemic, impact on funding, scientific productivity, teaching, institutional/social support, mental health, and details on COVID-19 status. Further, the survey also included questions for researchers who have left or were thinking of leaving academia. Interviews, on the other hand, focused on obtaining a detailed understanding of the impact of COVID-19 from the perspective of heads of institutes, suppliers of scientific materials, funders/donors, ECRs, people who were thinking about leaving academia, and those who had already left academia. As an incentive, participants were given an INR 100 voucher for completing the survey and INR 1000 for participating in the interview along with a certificate of participation from India Alliance and Monk Prayogshala.

Individuals 18 years and above, studying or working in a STEM-related field in India were recruited via targeted emails to Institute/Department heads, networks of India Alliance, and snowball sampling using social media campaigns. A total of 1074 participants took part in the online survey (July to November 2021), while 24 stakeholders participated in the interview. After cleaning the survey data for inconsistent and incomplete values, a total of 300 participants were noted to have completed their doctoral or postdoctoral

training and 318 participants who had either completed their post-graduation or graduation. Of the total 300 participants, 150 were men, 141 were women; and 149 participants belonged to a dominant caste group whereas 36 participants belonged to an oppressed caste group. Although project aimed to assess COVID-19 impacts based on caste distributions of STEM scientists in India, the data were insufficient to draw any robust conclusions.

The in-depth interviews were conducted with a subsample of heads of institutes (HOI; 8), representatives from funding agencies (3), suppliers of scientific equipment and materials (4), other stakeholders (4), and ECRs who were planning to leave academia (5).



Key findings

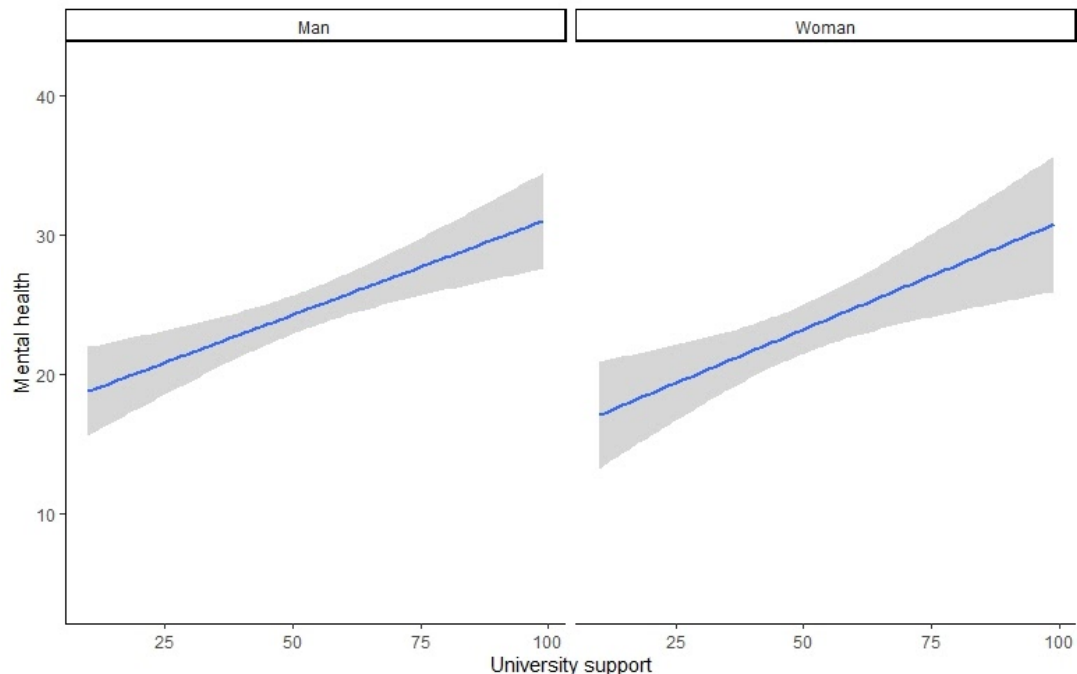
1. *Support matters for mental well-being and productivity*

About 48% of the ECRs noted experiencing a negative impact of the pandemic on their mental well-being in terms of deteriorated work-life balance, more stress, being unhappy, and poor mental health. Better mental health was enabled by lower difficulties in receiving a grant, better university and social support, and fewer disruptions to scientific productivity. University support refers to how supported scientists felt by university administrators and any flexibility in working hours, whereas social support refers to support received from family and friends. The results on university support are driven by men (that is, these results are not significant among women), suggesting that efforts can be made to extend more robust support from universities and institutions to women scientists affected by the pandemic. **Around 47% of researchers reported receiving lower than average support from their universities.**

Responses from ECRs: This is corroborated by qualitative evidence from interviews with ECRs. Despite having some social support, traditional gender roles could still hamper women’s scientific productivity and mental health (in part due to lack of work-life balance, but also due to lack of accessing university facilities).

Responses from Hols: Interviews with university and institute heads suggested that they took efforts to provide more support to impacted scientists. This included drawing up plans for work-from-home enabled

better work and time management for their researchers and staff, especially for those involved in teaching activities as well. Funding deadlines were extended (often at no-cost), salaries were not stopped or delays were mitigated in efforts to keep researchers motivated. Hols also kept connected with hospitals, setting up counselling facilities, and organised vaccination drives to support staff and scientists.



Responses from funders: In line with support emphasised by ECRs, interviews with funders revealed some adjustments to funding disbursement and policies during the pandemic and lockdown period. Funders said that they pivoted to funding COVID-19 research, eased milestone-linked funding disbursements, and granted no-cost extensions to facilitate continuation of work that was disrupted by lockdown restrictions.

Similarly, experiencing core research issues during the COVID-19 pandemic such as inability to discuss work with colleagues, facilitate lab meetings, and methodological challenges in research was predicted by lower mental health for all scientists in our sample. In turn, facing these core research issues reduces scientific productivity for all scientists, especially for men scientists. **It was noted that 51% of researchers reported experiencing a greater amount of core research issues as compared to the average.**

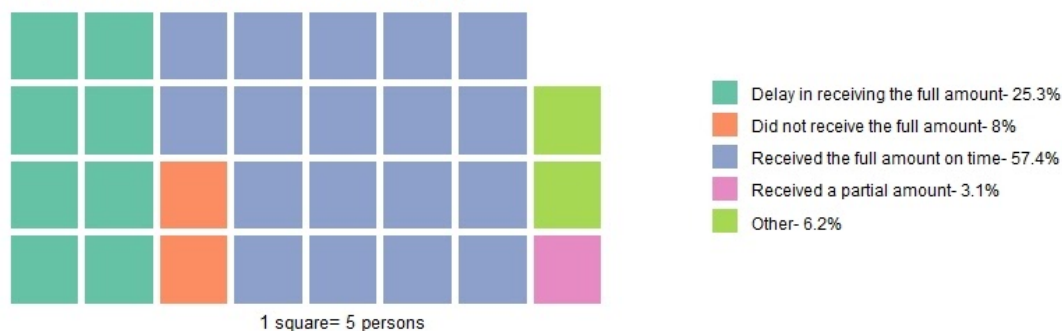
2. Disruptions to scientific productivity and grant disbursements

Following on from changes in funding disbursement and institute policies, pandemic and lockdown-induced disruptions to the grant disbursement and administration process led to a slowdown in procurement of lab supplies for men scientists and contributed to lower mental health among women scientists. **Approximately, 55% of the researchers mentioned facing greater difficulty in receiving a grant or a fellowship.**

Responses from ECRs: The evidence from surveys matches closely with findings from interviews with ECRs. Our qualitative interviews with ECRs reiterated that they often did not receive grants and salaries on time, leading to poorer mental health and motivation.

Responses from Hols: Heads of institutes in qualitative interviews echoed these findings, which they acknowledged had some downstream impacts on research issues. Specifically, they mentioned that there were some funding cuts, as well as supplies were constrained, especially due to disruption in supply chains and lockdown restrictions, which can have significant implications for core research issues faced by scientists.

Impact of the pandemic on payroll



Responses from suppliers: The challenges faced in grant disbursements appears to spill over into procurement of supplies, a finding that is supported by interviews with suppliers of scientific equipment. For example, suppliers were required to pay more shipping charges (up to 3x in some cases) which were borne by suppliers; they also faced delays not just in delivery but also installation. This was exacerbated by changing government regulations related to transportation and movement of scientific equipment. They also faced issues in particular for shipping from specific regions/countries (e.g., China). Suppliers felt that funding was reduced due to the change in funding focus to COVID-19 related science.

Finally, there were further consequences of this disruption to procuring lab supplies, which survey evidence indicates was associated with a significant impact on supervisory duties (especially for women scientists). This is possibly due to the additional time taken to resolve procurement issues, which leaves scientists with less time for supervisory work.

In response to this, qualitative data from interviews with Hols suggested that several institutes and universities helped set up virtual classrooms and conducted training sessions to help faculty make the transition to digital teaching (despite the quality of teaching reported to decline) and supervision of research scholars.

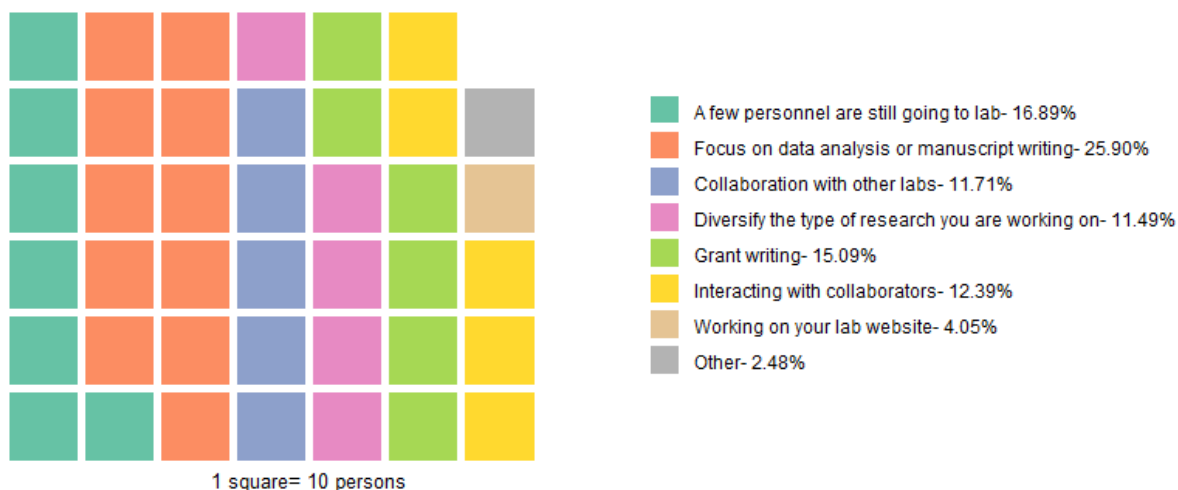
3. Financial uncertainty not associated with scientific productivity

Personal and household financial stability induced by the pandemic did not appear to significantly predict any changes in scientific productivity (except for women), mental health, or any major core research issues. This is despite the fact that a majority of our sample reported experiencing some difficulty in terms of financial stability during the COVID-19 pandemic and lockdown. **About 39% of the ECRs denoted being less financially secure since the lockdown in March 2020.**

Responses from ECRs: Although there was no direct mention of the loss of financial stability, interviews with ECRs revealed that many of them were already saddled with lower financial stability. ECRs also reported greater distress due to job insecurity, loss of regular sources of income, and lower mental health.

Responses from Hols: Hols did not specifically highlight in their interviews how they dealt with financial stability issues personally. However, Hols reported that faculty also had to deal with queries and concerns from students about financial stability and economic uncertainty. Given that students lost their primary place of learning, they faced various household issues that may have affected their learning.

Maintaining productivity within lab



Implications

This research lays groundwork on the importance of addressing the impact of the pandemic on understudied groups in science in India, like women and individuals belonging to oppressed castes. Along with providing a detailed understanding on the various challenges faced by researchers in the STEM community, the current study also illuminates the needs of these researchers (like, importance of social and university support) in order to increase (or maintain) their scientific productivity and improve mental health during the pandemic. Noting the impact of the pandemic on mental health of researchers, an important inference from the study is normalising talking about mental health and providing necessary resources to academics to improve their mental health and build coping resources.

The study has many policy implications, such as the need for providing training and development programs to STEM scientists in areas like technological skills and digital literacy, to provide opportunities for upskilling researchers/professors, and being able to transition to hybrid/online working. Furthermore, developing standard operating procedures (SOPs) across domains of teaching and research is vital to alleviate any future losses in academia (in terms of human resources, for example). This is particularly important given the highly specialised nature of skills required by STEM scientists. Further, sectoral instability in research and development can pose significant implications for economic productivity, particularly in a post-COVID world. Finally, setting up reserve funds for researchers to provide funding opportunities should be considered, which would enable them to continue their research work in the case of any such future contingency.