



Dread in Academia – how COVID-19 affects science and scientists

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ABSTRACT: In order to gain an insight into scholars' concerns emerging from the COVID-19 crisis, we asked scientists from all over the world about their attitudes and predictions regarding the repercussions of this current crisis on academia. Our data showed that the academic world was placed in an unprecedented situation. Results further showed that everybody worked on-line, conducting studies was impossible or highly impeded, and lab work was difficult. Almost a quarter of all scientists participating in our survey were anxious about their scientific employment, and over 25% expected serious financial losses as a consequence of the pandemic. Moreover, we identified sex differences regarding the severity of the COVID-19 impact in the majority of questions. We inferred from this that women perceived to be in a worse situation than men.

KEY WORDS: COVID-19, academia, scientists, gender differences, pandemic

Introduction

As of August 16th, 2020, over 21,000,000 people were diagnosed as being infected with COVID-19, of whom more than 760,000 died (WHO 2020). Besides the most salient, health-related problems, pandemics – like the one we are currently experiencing – have numerous short term and long term consequences. For instance, a COVID-19 threat may result in a shift in political views (Karwowski

et al. 2020), may increase xenophobia (Sorokowski et al. 2020), and may also affect the everyday lives of people from across the vocational spectrum (Baldwin and di Mauro 2020). Many global research networks joined forces to investigate how psychological and behavioral responses to the COVID-19 pandemic differ across countries and cultures (e.g., Kowal et al. 2020; Lieberoth et al. 2020). Here, we aimed to test whether the COVID-19 crisis has affected scien-

tific research and academic careers and whether COVID-19 has revealed sex differences in universities.

Historically, universities have been places for developing critical understanding and promoted the exchange of ideas among freely interacting community members. Ironically, while fulfilling their missions, universities are currently being at risk of unintentionally contributing to a further COVID-19 spread. Thus, it comes as no surprise that many countries decided to temporarily ‘close the gates’ to all higher education institutions and insitigate online learning (see Figure 1 for an overview of countries where educational institutions have been closed at the time of the conducting the present study and Figure 2 for the current period). Such strategies have been shown to significantly inhibit large viral outbreaks (Kawano and Kakehashi 2015; Markel et al. 2007). Although online learning has

been effective in promoting community health, this new teaching methodology may affect traditional academic pedagogical regimes.

It should be noted that quarantining university students during pandemics/epidemics are not unprecedented. During the Great Plague of London in 1665, Cambridge University also sent all students home. One of them – a 23-year-old, named Isaac Newton, used the 18 month-long quarantine to develop the theory of light and color, invent the method of infinitesimal calculus, as well as explore and investigate the laws of planetary motion (Westfall 1999). It is further assumed that the famous encounter with a falling apple also took place during the quarantine period. These seminal scientific discoveries exemplify the benefits of temporary quarantining. It has been argued that for highly motivated individuals, quarantining may

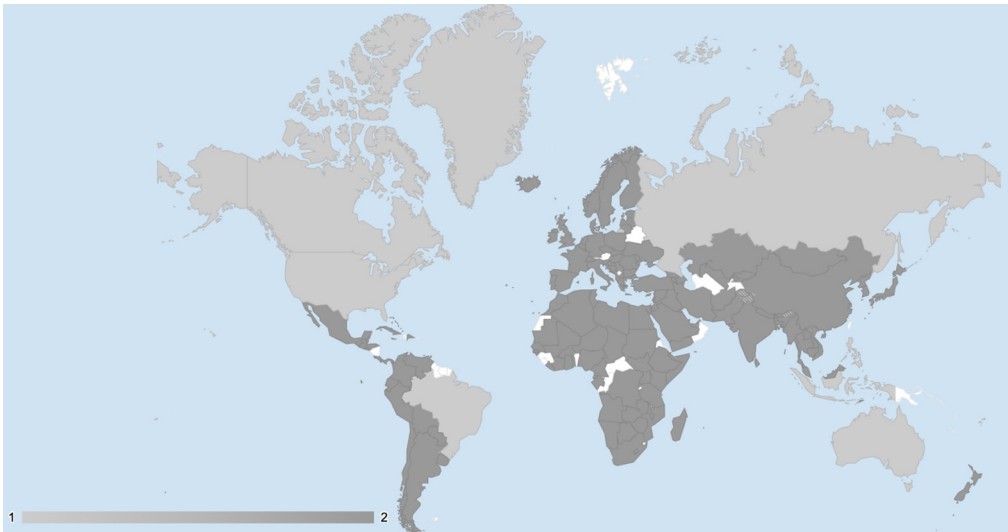


Fig. 1. School closures by COVID-19

1 (light gray) – localized closures; 2 (dark gray) – country-wide closures; white – no data.

Based on 25.03.2020 UNESCO Institute for Statistics data (<https://en.unesco.org/themes/education-emergencies/coronavirus-school-closures>).

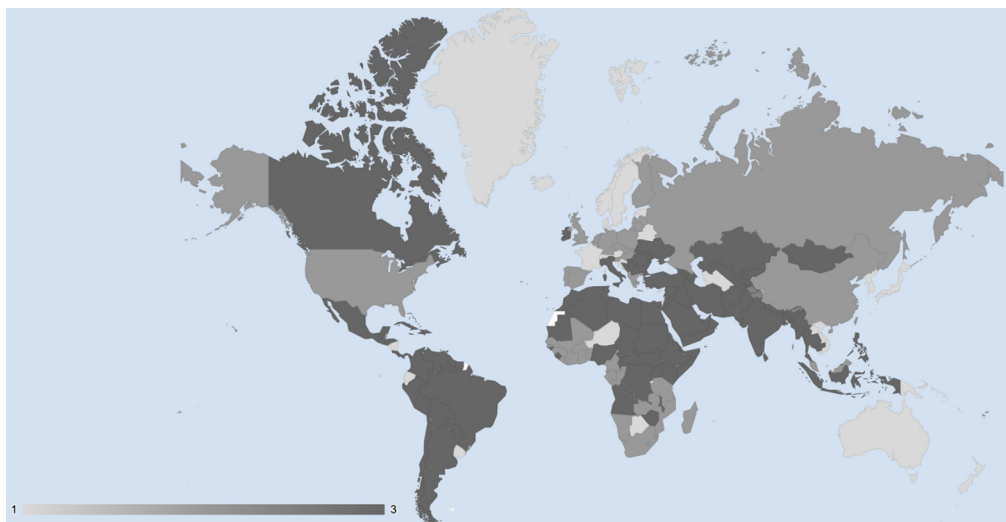


Fig. 2. School closures by COVID-19

1 (lightest gray) – open; 2 (medium gray) – localized closures; 3 (darkest gray) – country-wide closures; white – no data.

Based on 03.08.2020 UNESCO Institute for Statistics data (<https://en.unesco.org/themes/education-emergencies/coronavirus-school-closures>).

foster scientific ideas. However, scientific milestones need more than devoted and well-organized scientists. Pandemics restrict mobility and the possibility of a direct contact with collaborators and prevents access to laboratories, crucial for scientific research and development. Additionally, increasing household responsibilities, mainly due to the unavailability of childcare services during the pandemics, reduce, not increase science research. Female scientists, especially women of color and young mothers, are mostly affected (Myers et al. 2020). Indeed, it is difficult to picture Isaac Newton inventing calculus while cooking dinner with a preschooler tugging on his sleeve, followed by teaching an online class. The inability to engage in their research work or supervise ongoing studies means that for many scientists their scientific work may be seriously compromised or annulled.

The closure of higher education institutions has several consequences not only for science, but also for the process of education itself. It may negatively impact students' knowledge acquisition. For example, Argentinian students who missed school during a long teachers' strike were more likely in the future of having decreased income and higher risk of being unemployed when entering their thirties (Jaume and Willén 2019). Many academic teachers have committed themselves to developing new online learning courses. However, due to the rapidity of the current pandemic, many teachers may have not been sufficiently prepared for developing quality online courses. Academia's new goal is to prove that e-learning can substitute traditional pedagogical methods (e.g., Singh and Hurley 2017).

It is also highly likely that the expected economic recession caused by

the pandemic might reduce subsidies for scientific research and affect financial resources available for higher education, especially in domains that do not tackle the COVID-19 crisis. Financial problems facing potential or current students may decrease their ability to cover education costs, which would likely reduce financial resources of many higher educational institutions. Furthermore, a shortage of funds may curtail initiatives supporting employment diversity and equality, further exacerbating gender differences in the scientific community. Also, damage caused by the pandemic to academia may further increase fear and uncertainty in the most resilient and organized academics.

Material and Methods

To gain an overview of scholars' concerns related to the COVID-19 outbreak, we conducted a global survey and asked 12,000 scientists from all over the world about their attitudes and predictions regarding the repercussions of COVID-19 on academia. We first identified corresponding authors of papers published in journals indexed on JCR list, from one of the three research areas, i.e., psychology, biology, and philosophy ($N = 12,000$). Next, we sent an email invitation to participate in our survey to all the authors. The invitation provided a short description survey's aim (i.e., how COVID-19 has impacted on scholars' lives), and a link to the online survey, consisting of ten questions and basic socio-economic measures (i.e., age, gender, and nationality). Shortly after (2–3 days) sending the email invitations, we received 558 responses. Participants were not com-

pensated for their participation. Our respondents came from 53 countries (with the largest numbers coming from the USA, UK, Italy, and Germany; see supplementary material, which can be found under the link: <https://doi.org/10.6084/m9.figshare.12045234> for a detailed description of participants' nationalities). The participants were aged between 25–88 years ($M = 44.74$, $SD = 12.26$). Forty percent of the sample were women ($N = 221$). Survey questions concerned scholars' current situation and whether COVID-19 has had any negative impact to their careers. Response options ranged from 1 (completely disagree) to 7 (completely agree), with the highest numbers reflecting the most severe problems.

Results

Our data (accessible via link: <https://doi.org/10.6084/m9.figshare.12045234>) showed that the academic world was placed in an unprecedented situation (see Figure 3). Results further showed that everybody worked on-line, conducting studies was impossible or highly impeded, and lab work was difficult. Even the relatively low means in the questions on a financial stability and employment indicate severe problems: almost a quarter of all scientists participating in our survey were anxious about their scientific employment, and over 25% expected serious financial losses as a consequence of the pandemic. Moreover, we identified sex differences regarding the severity of the COVID-19 impact in the majority of questions. We inferred from this that women perceived to be in a worse situation than men (see Table 1).

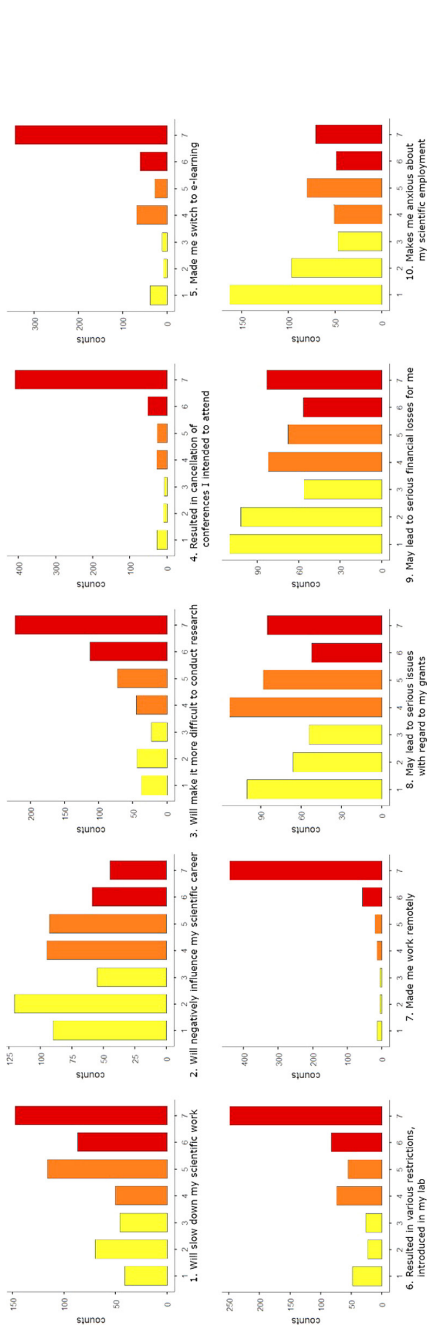


Fig. 3. Bar plots depicting participants' (N = 558) answers on survey questions beginning with 'The current situation with coronavirus...' (ranging from 1–7 completely disagree to 7–1 completely agree). Very high scores are highlighted in red, high scores in orange, and the remaining scores are in yellow.

Table 1. Sex differences regarding the survey questions (N = 551)

The current situation with coronavirus...	t	p
1. Will slow down my scientific work	-3.426	<.001
2. Will negatively influence my scientific career	-3.330	<.001
3. Will make it more difficult to conduct research	-4.733	<.001
4. Resulted in cancellation of conferences I intended to attend	-2.535	0.012
5. Made me switch to e-learning	-2.165	0.031
6. Resulted in various restrictions, introduced in my lab	-1.713	0.087
7. Made me work remotely	-1.028	0.304
8. May lead to serious issues with regard to my grants	-3.369	<.001
9. May lead to serious financial losses for me	-1.050	0.294
10. Makes me anxious about my scientific employment	-2.185	0.029

Note: Significant results indicate that women perceived the COVID-19 situation as more severe than men.

Discussion

The results of the present worldwide survey show the magnitude of the negative impact that COVID-19 has on academia, what is in line with other studies (e.g., Korbelt and Stegle 2020; Vandebroek et al. 2020). Moreover, we observed large sex differences, with women perceiving their current situation as being worse than men's. This finding corroborates with previous analyses (Cardel et al. 2020; Myers et al. 2020). Studies have showed that female researchers performed more housework and childcare before the pandemic (Harvard survey 2020; Johnston et al. 2020). However, Myers et al. (2020) reported that during the lockdowns, females experienced greater reduction in work time compared to their male col-

leagues. Our findings suggest that research output of young female scientists is likely to be the most affected. Early pandemic data reveals that female academics have been struggling to meet their publication goals more than men (Staniscuaski et al. 2020). With parenthood recognized as being a major culprit for the attrition of young scientists, especially female, early in their research career (Goulden 2009; 2011; Cech 2019), uncertainty surrounding childcare availability poses a risk to the prospects of early female career researchers.

What can be done in the current situation to mitigate these effects? What strategies can be adopted to reduce the burden of academic pressure? Tenure committees, granting agencies, and recruitment committees should take into account the COVID-19 pandemic when assessing applications. Firstly, all deadlines should be extended and scientific positions kept, albeit, prolonging deadlines might not yield the intended results for female scientists (Antecol et al. 2018). At best, funders should allow funds to be relocated to new, emerging research dedicated to the most pressing issues. Moreover, governments should increase financial investment in science in order to stimulate research and academic careers. The evaluation of scientific accomplishments should be conducted in an equitable manner according to the "Achievement relative to Opportunity" policies. We need to initiate strategies for reducing the negative psychological or health effects of isolation, as well as pandemics' negative effects on markets. Further, we need to understand how new teaching methods affect both students and staff in order to develop efficient strategies for online learning. Fortunately, many top-tier international journals

have reacted in a timely fashion by announcing public calls for papers to stimulate research that address the current global crisis. We argue that, despite the current difficulties and challenges, academia can positively contribute in maintaining scientific research and development. Perhaps one day, the COVID-19 pandemic will be remembered as an event which saw the emergence of great minds and significant breakthroughs, similar to the Great Plague of London in 1665, which provided the stimulus for Isaac Newton's seminal ideas.

Although the present study has attempted to improve our understanding of COVID-19's impact on science and academia, it is not without limitations. Firstly, a final response rate constituted only 4.9% of the initial number of survey invitations. Also, we do not know with any certainty if most of our emails were automatically redirected to spam folders or whether scientists ignored our invitation to participate. In addition, we cannot exclude the possibility that those who have been particularly affected by the ongoing crisis were more interested in participating in our online survey. Lastly, all the variables were skewed and violated the assumptions of normality, which has limited our ability in drawing any general conclusions. However, what is worth noting is that the results of our study are comparable to the findings of other studies (Korbel and Stegle 2020; Myers et al. 2020; Vandebroek et al. 2020).

The Authors' contribution

Conceptualization: PS MKo. Investigation: PS MKo IL AGB MB AS MKa KK LW. Writing – original draft: MKo PS AS IL MB AMO. Writing – review & editing: AGB MKo PS AMO.

Conflict of interest

The authors declare that there is no conflict of interest.

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