

Results of the survey on the effects of the Covid-19 pandemic on LHCb scientists

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Abstract

In this note, we report the outcomes of a survey of LHCb scientists carried out during December 2020 regarding the social response to the Covid-19 pandemic. The survey was completed by 199 people, corresponding to about 14% of the collaboration. Amongst the most alarming issues, it was found that in particular the well-being of our younger colleagues, namely graduate students and especially post-docs, has deteriorated. This is indicated by their lack of productivity, motivation, focus and a big decline in their mental health since the beginning of the crisis. In view of these worrying results, we provide a series of suggestions hoping that this report can help to increase the awareness about less debated effects of the Covid-19 pandemic, in particular on our younger colleagues.

1 Introduction

This note documents the outcomes of a survey conducted in December 2020 within the LHCb collaboration. The survey was designed to assess the effects of the Covid-19 pandemic and its consequences on scientific researchers. The questions ranged from the suitability of researchers' home-office set-up, to how their sleep has been affected, to their productivity and mental health.

From a professional point of view, research has largely been able to continue remotely. LHCb collaboration meetings and workshops have been held virtually since March 2020 and there have been several successful international conferences, which have been completely virtual for the first time. However, travel limitations have impacted the installation of new detectors in the LHCb cavern. Several attempts have been made to preserve the collaborative spirit of LHCb and social activities, thanks to virtual coffee breaks, virtual barbecues and quizzes. Nevertheless, the impact of Covid-19 on collaborators' well-being has been significant in a non-negligible number of cases. This document attempts to quantify the effects of Covid-19 on scientists at LHCb and analyses the correlations with respect to factors such as career level and displacement from an individual's home country.

This document is structured as follows. Section 2 describes the survey methodology and collected data set, Section 3 describes the key quantitative findings of the survey, while Section 4 addresses the outcomes of the open questions. Section 5 documents some findings and comments that were raised during a public discussion within the collaboration. Finally Section 6 concludes with some reflections on the experience of this survey and recommendations for the future.

2 Survey methodology and collected dataset

LHCb is a collaboration of about 1500 members from 90 institutions based in 19 countries (as of April 2021), and representing many more nationalities [1]. The aim of the collaboration is to work together on experimental high-energy physics, and to do so in the best and most collaborative conditions.

The survey was supported by the Early Career Gender and Diversity (ECGD) office of LHCb [2] and developed by the authors of this note. It was implemented using the CERN Drupal infrastructure [3] and carried out online in an anonymous way. All persons subscribed to the lhcb-general mailing list, to which all LHCb members are automatically subscribed, were notified of the survey and given roughly one week to complete it. The distribution of answers received as a function of time from the first email announcing the survey is shown in Figure 1. Besides the first peak, other two structures are visible, corresponding to two reminders sent to members of the collaboration, underlying the importance of sending such emails. Accidental multiple submissions were prevented using the IP information of the computer used to submit the results. In total, 199 collaborators, representing 14% of all LHCb scientists, completed the survey.

The respondents answered over 45 specific questions addressing different topics, and also

Figure 1: Distribution of answers received as a function of time from the first email announcing the survey.

had the opportunity to submit longer textual answers and comments on the issues raised in the survey. None of the answers were mandatory, but collaborators were encouraged to fill in as many answers as possible.

The results of the survey have been subsequently presented to the LHCb collaboration during a dedicated ECGD meeting [4]. The main outcomes of the discussion that followed the presentation of the results during the meeting are also documented in this note.

3 Key quantitative findings of the survey

In the following we report the main findings of the survey. The survey indicates large differences between how non-permanent researchers (graduate students and post-docs on fixed-term contracts) and permanent researchers have been affected by the Covid-19 pandemic.

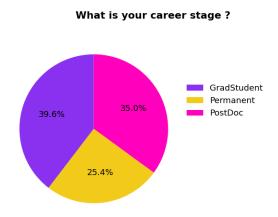


Figure 2: Respondent's career stage. In absolute numbers, we have collected answers from 9 Master's students, 69 PhD students, 69 post-docs and 50 permanent researchers. Due to the small sample of Master's students, their answers were merged with those of PhD students and referred to as Graduate students.

The career-stage distribution of the respondents is shown in Figure 2. Out of the total of 199 replies, we have collected answers from 9 Master's students, 69 PhD students, 69 post-docs and 50 permanent researchers. Two respondents did not disclose their career stage. Due to the small sample of the Master's student group, their answers were merged with those of PhD students. Thus, 39.6% of the respondents are PhD and Master's students (referred to as "Graduate students"), 35% are post-docs and 25.4% are permanent researchers. All plots in the following are normalised such that the total replies within a group add up to one. This includes the correlation plots.

A key question asked of the respondents is whether they were, at the time of the survey, living in their "home country" (the term used in the questionnaire) or abroad. We note that there is some ambiguity in the term, (e.g. between a person's countries of origin, of citizenship, of residence, of their family home, and of where they currently live), particularly in an international collaboration. In Figure 3 we report the exact wording used in the survey, which we deliberately left to the interpretation of the respondent. As can be seen, at the time of the survey 55.1% of the respondents lived in their home country, while 44.9% lived abroad. When correlating this answer with career stage, it is clear that graduate students and post-docs mainly live abroad, 41.6% and 66.7%, respectively, while the majority of the permanent researchers, 78%, live in their home country.

At the time of the survey, a large majority of respondents, about 70%, were working full time or mostly from home, with a slightly larger number of people working from home when living in their home country, as can be seen in Figure 4. Despite the fact that since Spring 2020 working from home has become routine for most of the collaborators, we find that, regardless of their career stage, about 30% of the respondents still do not feel comfortable (*i.e.* answered with 4 or 5 in a scale from 1 to 5) with the current remote work ergonomics (see Figure 6). Interestingly, the percentage of people not feeling comfortable at all (i.e. answered with 5) is significantly larger among those living abroad. We advise group leaders to take this into account, and to ensure that the ergonomics of their group members' home workspaces are appropriate.

Moreover, from the survey, as visible in Figure 5, it also emerged that a larger fraction of people in permanent positions are happy with the current situation: 41.7% compared to 29.5% and 34.8% of graduate students and post-docs, respectively. Additionally, while just under half (45.8%) of permanent researchers would like to work more frequently in the office, this percentage increases to 60.9% for post-docs and 67.9% for graduate students .

Questions on the respondents' work-life balance are shown in Figure 7, where one can see their satisfaction with their work-life balance, split by job status and living situation. Unfortunately, we do not have historical information to judge if a similar imbalance was present before the pandemic, or how much it was affected by Covid-19. About 50% of graduate students and post-docs report not being able to maintain a work-life balance, which is a worrisome number. Whereas those of them living in their home country are already unsatisfied about this balance, it is even worse for those living abroad. We advise team leaders and institutes to pay more attention to the work-life balance of their colleagues/employees, since a distortion of the work-life balance creates a higher risk of burn-out and dissatisfaction with one's work. They can encourage optional informal online meetings among colleagues/employees, such as a chat, a quiz, a coffee break or an online game, if people feel comfortable with spending more time online. At

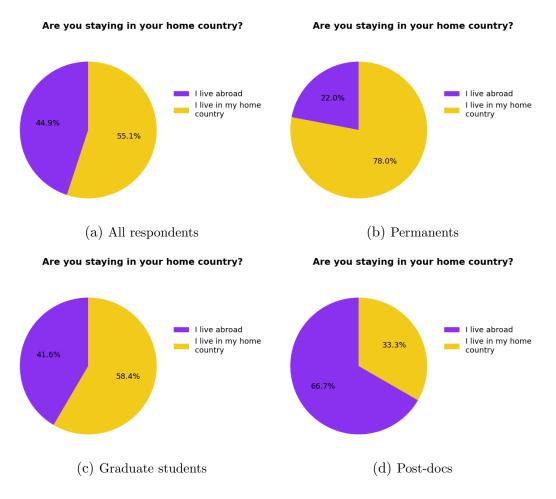


Figure 3: Living situation (i. e. living in country of origin/abroad) for all respondents (a) and separately for permanents (b), graduate students (c) and post-docs (d).

the same time, it could help if group leaders can make clear that people have the right to disconnect, both on a daily basis and/or on vacation, and they do not expect people to be continuously available. Work-life balance is correlated with the self-assessment of productivity for graduate students and post-docs with a correlation coefficient of 0.2. This is shown in Figure 15 of Appendix A.

Productivity and motivation changes during the Covid-19 crisis are another important measure for the collaboration. Full results on work-related effects can be found in Appendix B. In Figure 8 one can see results of a self-assessment of productivity compared to pre-crisis times and the current motivation of respondents. Graduate students have the worst self-assessment of their productivity, followed by post-docs. On the other hand, many permanent colleagues are actually experiencing a rise in their subjective productivity. There is no real difference in terms of productivity depending on the location of the respondents. The self-assessed productivity is correlated with the motivation to work that respondents experience. The correlation coefficient between the two measures is -0.5 for graduate students and post-docs, as can be seen in Figure 17 (b). Motivation levels are high for the permanent staff, where more than 50% are motivated to work nearly every day. Conversely, about 60% of the graduate

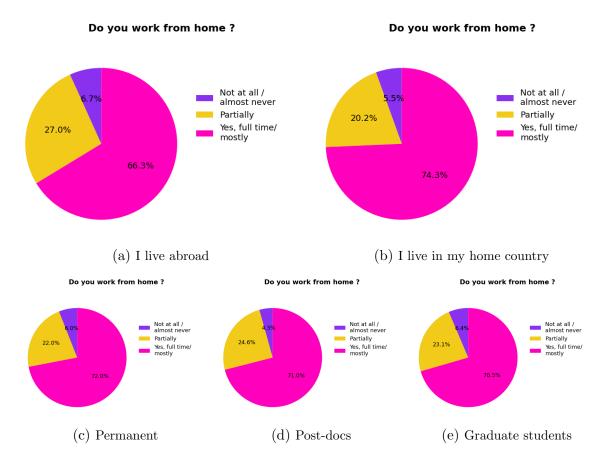


Figure 4: Percentage of respondents that currently work from home. No large differences between the various categories are visible.

students and post-docs are motivated only several days a week or more than half the days (the percentage is almost equally split between two categories). About 15% of post-docs and graduate students report not being motivated at all. Among all the post-docs living abroad, the motivation is a bit lower than for those living in their home country.

Despite the availability of the Mattermost network, and regular group and working group meetings held over Zoom, many respondents experience a lack of communication with their colleagues, see Figure 9. More than 30% of the graduate students and post-docs are unhappy with the frequency of communication with their colleagues, and about 10% are very unhappy with this. More than 80% of permanent staff members are in general happy with the frequency of communication they have (answered 1 or 2). Comparing between living situations, colleagues that live abroad are less happy about their frequency of communication, than those living in their home country.

Stress and anxiety levels were also addressed by the survey. The full results are quoted in Appendix E. The assessment is strictly personal and subjective, and we do not pretend to be mental-health professionals, but even to the untrained eye it shows a significant, negative trend in the well-being of collaborators. In Figure 10 the self-assessment of mental health is shown as evaluated at the time of the survey (top plots) and in comparison to pre-Covid-19 times (bottom plots). Focusing on the mental health status at the time of

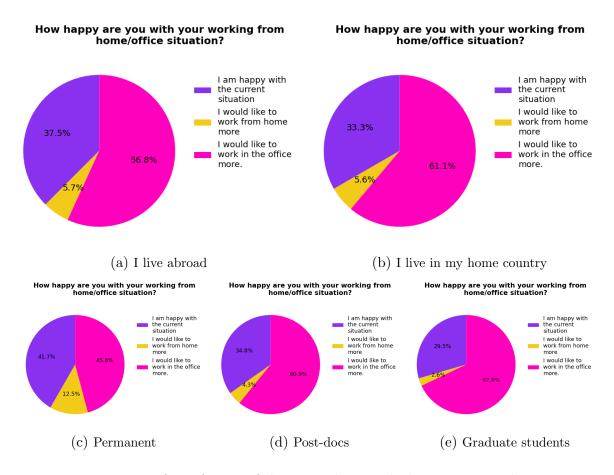


Figure 5: Percentage of satisfaction of the respondents with their current working situation.

the survey, about 20% of graduate students, more than 30% of post-docs and about 15% of permanent staff would rank their mental well-being as quite or very bad (answer 4 or 5). The numbers are particularly striking for post-docs. On the contrary, the majority of permanent staff would rank their mental health as good. For people in their home country, the self-assessment of mental health shows better results than for those living abroad. (We note the overlap between these statements: the majority of post-docs and a substantial minority of graduate students live abroad. We did not attempt to evaluate the correlation between these two effects.)

When asked to assess their mental health in comparison to pre-Covid-19 times, the answers skewed towards a more negative assessment of personal mental health. More than 50% of graduate students, 45% of post-docs and about 20% of permanent staff experienced a big decline in their mental health state (answer 4 or 5), since the beginning of the crisis. Again, the impact is larger for graduate students and post-docs. Similarly to what already observed for other questions, colleagues living abroad report worsening of their mental health compared to pre-crisis times.

In the survey more than 35% of respondents agreed that they received enough mental health support from their supervisor, see Figure 11. On the other hand, more than 10% of respondents strongly disagreed (answer 4), and about a further 20% received less support from their supervisors than they might want or expect (answer 3). Taking into account that the current situation is extraordinary, we would advise supervisors and team leaders

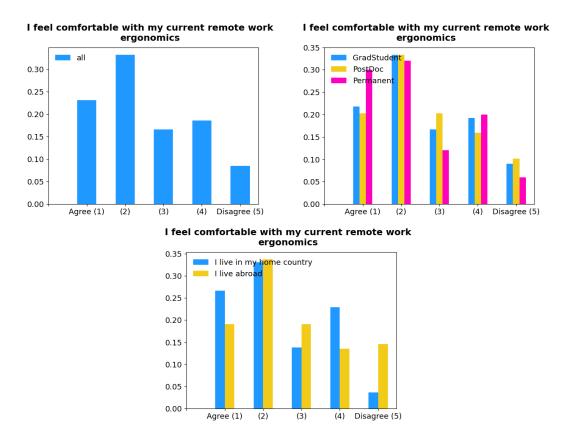


Figure 6: Comfort with remote work ergonomics split by career and living situation.

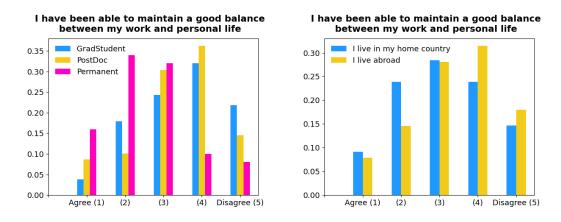


Figure 7: Satisfaction with work-life balance split by career and living situation.

to pay particular attention to the well-being of group members and supervised students. This is especially crucial for those living abroad who do not have an extensive network of friends and/or family support. Informal meetings can be organised one-on-one or in groups, depending on what colleagues find most comfortable. Do not hesitate to reach out to someone who seems to be lonely or who is currently in a difficult situation. It must be noted that despite these points of critique, it is also understood that many supervisors are doing their best in this exceptional situation.

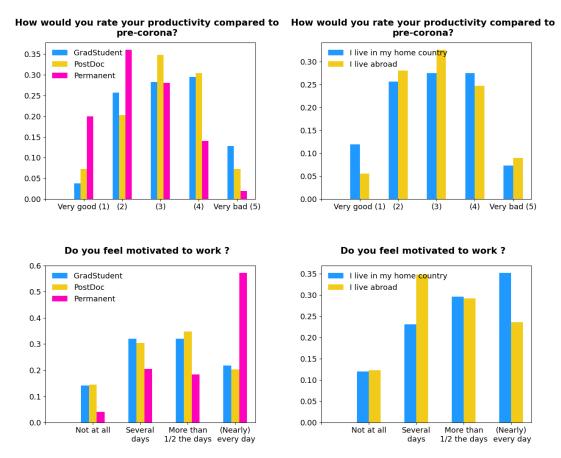


Figure 8: Self-assessment of productivity, compared to before the Covid-19 pandemic and motivation levels split by position and living situation.

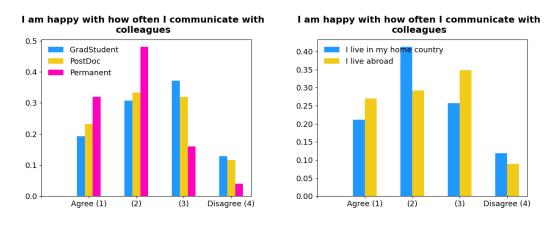


Figure 9: The satisfaction with frequency of communication split by position and living situation.

4 Key findings open questions

The questionnaire also included two open-ended question. The first of these was "Is there anything else we should know?" and the second was "Is there any initiative that is done in your group that may be of interest for the LHCb collaboration?" The answers varied a lot, occasionally also contradicting each other. A summary of the answers is given below,

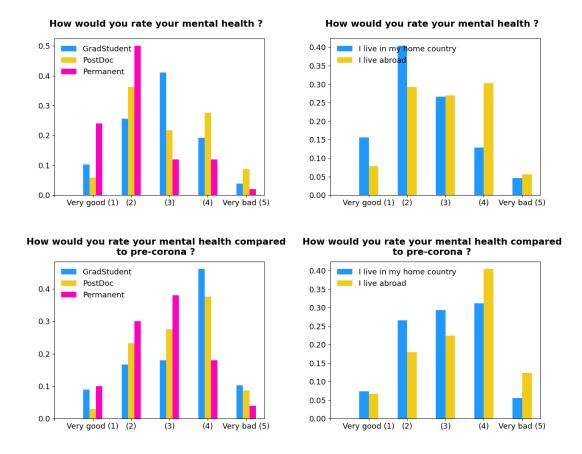


Figure 10: Self-assessment of general mental health and compared to before the Covid-19 pandemic, split by position and living situation.

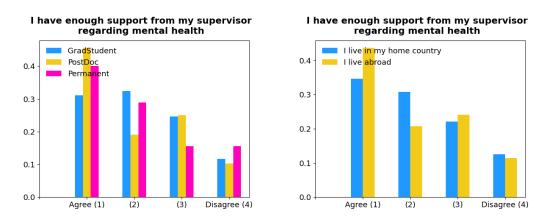


Figure 11: Self-assessment of mental health support split by position and living situation.

grouped by topic.

People noted concerns that their responses to the survey might reflect personal circumstances not directly related to the crisis, such as their physical health (not Covid-19 related), seasonal depression, and poor access to health care. Some people may even thrive under the current circumstances, perhaps being forced to slow down at work and having more time for family responsibilities, or by becoming more independent as researchers since they have less contact with their supervisor.

Feedback on the questionnaire Most people were happy with the questionnaire. There were also some suggestions to improve it. One was to add information on people's living situation: do they live alone, or with housemates, partners, or children? Another suggestion was to ask master and graduate students when they started their degree, and specifically if this was before or after the lockdown started. A point of critique was that the questionnaire seems to assume good mental health pre-Covid. Some people requested monitoring over time, as mental health can change a lot.

Meetings It was mentioned that it is harder to pay attention to meetings now that most of them are remote, and there are more than usual. Active participation and discussion during meetings are encouraged. There seems to be a split between two groups of people: those who have too many meetings to attend, and those who feel isolated with too few.

Concerns It was pointed out that it is very stressful to move between countries now, and it is especially hard to make new connections. Another big cause of concern is that people find it much harder to concentrate on the more complex tasks of their work. In addition, people think that hardware or software tasks are even less visible than usual with respect to physics analyses. This is a long-standing issue for High Energy Physics collaborations that could be exacerbated by the pandemic. The lack of visibility in general, and the above worries, coalesce as a fear that those with short-term contracts may not to be able to find a new job.

A completely different kind of concern is that of those trying to follow all the rules and seeing others ignoring them. It would be appreciated if at least at the working place, rules would be strictly enforced.

Group initiatives We received many comments about virtual coffee meetings. In general informal (often not work-related) meetings are very much welcomed. These could be organised daily or weekly. Daily meetings can be difficult to sustain over time and have died out at some institutes. At other places, however, they work very well. In addition, one-to-one informal meetings, if possible, can be arranged in person, and reduce stress levels. It is important not to make all these social activities compulsory, as some of our colleagues indicated they do much prefer spending time away from their screen. When it comes to LHCb social activities, it was pointed out that these are hard to attend when you do not live in Europe, given that they are usually held late in the afternoon in CET.

Another informal way to stay in touch is through Mattermost channels, which are often already used individually or by groups for work-related chats. The use of more informal channels would also be welcomed and is encouraged.

In addition to this, some universities are providing professional help. This can be in groups, such as lunchtime mindfulness/relaxation sessions, or as individual training. On the other hand, some people would appreciate support from a psychologist and cannot afford this. We advise group leaders to learn about and inform their members of available resources. In general, active lunchtimes are much encouraged, preferably outside.

Some respondents reported that their group leaders had suggested that they did not take holidays, on the grounds that at present we cannot travel or leave home. This is a very worrying since it is important for mental health that we all take regular holidays, as a means to relax in these stressful times.

5 Comments

After the results were presented to LHCb in a collaboration-wide ECGD meeting, a discussion followed and several comments were raised. There was a desire for a "mood-meter" scheme that would monitor the situation over time. This would consist of a set of five questions that respondents would answer every week, namely

- 1. This week I generally slept...(from very bad to excellent);
- 2. This week when I woke up in the morning my energy and motivation levels were generally...(from very bad to excellent);
- 3. My productivity this week was overall...(from very bad to excellent);
- 4. This week I felt lonely/isolated...(from not at all to always);
- 5. This week I did things that made me feel good, like hobbies/exercise/meeting people (from none to many).

For this regular questions, we have adopted a more granular scale from 1 to 10, based on feedback. The outcome of these trends will be especially interesting as restrictions ease.

As pointed out by one of the respondents in the comments to the survey, the increase in permanent staff productivity compared to pre-Covid-19 times could be an effect of reduced presence in the office. Since the online environment raises the threshold to ask questions, permanent staff are less occupied and can afford to work on personal projects. However, it was also mentioned that part of the permanent staff are completely overwhelmed by the current workload, sometimes in combination with home-schooling. Some of them already told us that they missed the survey due to this, suggesting that these results may be biased.

We strongly encourage the creation of a lower-threshold environment for asking questions within your group, especially for technical questions. The normal "network" of an average graduate student has shrunk, because of lack of access to office mates or other colleagues who otherwise could have helped. Some institutes host special PhD-only or post-doc-only meetings in the presence of one senior staff member to help early career colleagues debug issues and to give advice on their projects. Note that this support system must not replace supervision, but rather can serve as an important addition to it. There are also anonymous question tools available online that can be set-up for technical and basic questions.

Another important point that was raised during the discussion concerns the lack of possibility to connect with a network of collaborators and/or future employers through informal discussions at in-person international conferences or LHCb collaboration meetings. This will affect mainly new collaborators with short-term contracts that will need to search for a new job.

6 Conclusions

In December 2020 we held an online survey to study the impact of the Covid-19 pandemic on the work and life of the members of the LHCb collaboration. The survey was

completed by 199 people, corresponding to about 14% of the collaboration.

Amongst the most pressing points, it was found that the well-being of our younger colleagues, graduate students and especially post-docs, has deteriorated. This is indicated by their lack of productivity, motivation, and focus. We want to stress here that some of these situations might have been already present before the covid-19 pandemic, see e.g. Ref. [5]. We asked in several questions to rate the situation compared to pre Covid-19 in order to try to disentangle the effects. However it is difficult to understand if the pandemic exacerbated a long-standing situation and/or made it acceptable to talk about it.

We would like to stress some of the quantitative findings: about 15% of post-docs and graduate students suffer from not being at all motivated to work, and about 40% of them rate their productivity compared to pre Covid-19 as bad or very bad. Consistently, 20-30% of the early-career colleagues reported feeling very lonely, very isolated, anxious, and frustrated/helpless on more than half of the days. Most worrying is their evaluation of their mental well-being compared to pre-Covid-19 times. Indeed, more than 50% of graduate students, 45% of post-docs and about 20% of permanent staff experienced a big decline in their mental health since the beginning of the crisis, which is a very alarming result. This is worse for those living abroad, most likely because they lack the support of friends and family, which reflects in a worse work-life balance. In fact, about 50% of graduate students and post-docs, who are also those that mainly live abroad, are not able to maintain their work-life balance, which is a worrying percentage.

From a practical point of view, we provide a series of suggestions arising from the analysis of the survey results. From the survey it emerged that about 30% of the people receive less support regarding mental health than what they would like to have. Some people in particular would need psychological help and cannot afford it. We thus advise supervisors and team leaders, and possibly big organisations like CERN, to take this into account investing resources into the well-being of their people. This is especially crucial for those living abroad. We also emphasise the importance of informal meetings, both as a means to relieve the loneliness of, in particular, younger colleagues, but also as a low-threshold environment for asking work-related questions, given that now graduate students have few other possibilities. This can also be achieved through to anonymous question tools available online.

Another important element to consider is the difficulty that colleagues with short-term contracts will experience in the next years to find a new job. A specific issue arises for people working on hardware or laboratory-related tasks (but also software tasks due to the lack of support) who will not manage to finish their assignments and/or publish their work. More broadly, early-career scientists are faced with difficulties from the struggle to create a network of collaborators and/or future employers in such a travel-limited situation, to the mental issues and low productivity mentioned before. Given the broad range of threats and the large fraction of people affected, we recommend, whenever possible, extensions of current PhD and post-graduate contracts. (We would particularly like to encourage permanent staff, who on average are less impacted by the current difficulties than early-career researchers, to take note of the quantitative survey results and consider them when setting policy.)

Another outcome of the survey is the request for a regular monitoring of the collaboration's well-being. Consequently, a brief weekly questionnaire, or mood-meter, consisting of five questions was put in place in the LHCb collaboration since February 2021.

Finally, we would like to underline that none of the authors involved in this study is a social scientist, nor trained to properly develop and evaluate the outcome of such a survey. However, we hope that this study can help to increase the awareness about the effects of the social response to the Covid-19 pandemic, in particular on our younger colleagues, such that appropriate mitigating actions can be planned. Moreover, we hope that this note will trigger reflection on the importance that such studies be carried on a wider scale, using appropriate methods and techniques.

Acknowledgments

We would like to thank Joel Closier for the implementation of the survey in the Drupal infrastructure, Matthew John Charles and Monica Pepe-Altarelli for providing useful comments and helpful suggestions and all our colleagues that took the time to fill out the survey.

A Personal ties

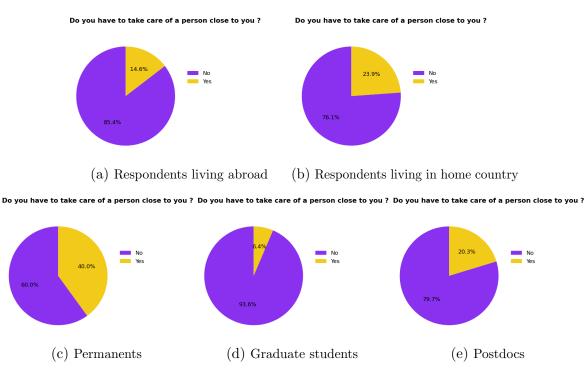


Figure 12: Respondent's caring responsibilities.

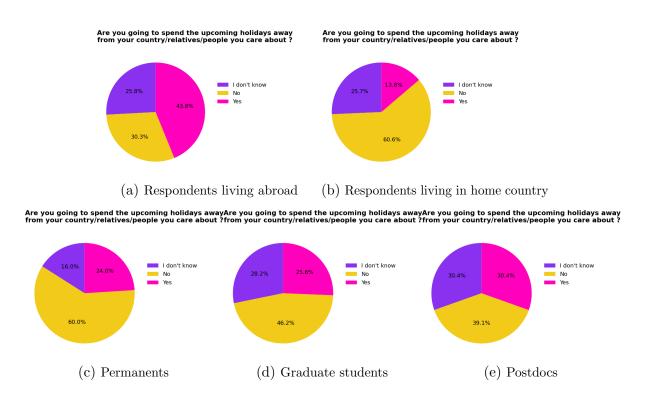


Figure 13: Respondents' holiday plans with respect to location and ability to be with loved ones.

Are you or someone close to you directly physically Are you or someone close to you directly physically affected by COVID?

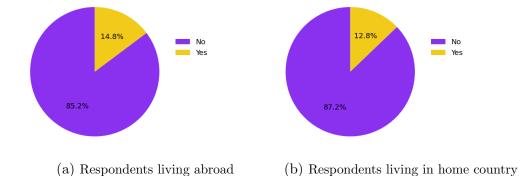


Figure 14: Covid-19 effect on respondents' close circle split by living situation.

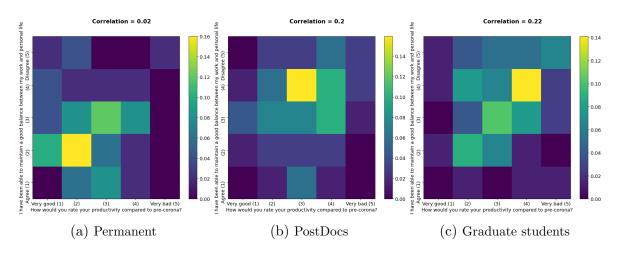


Figure 15: Respondents' life-work balance correlated with their self-assessment of productivity split by position.

B Work-related effects of the Covid-19 pandemic

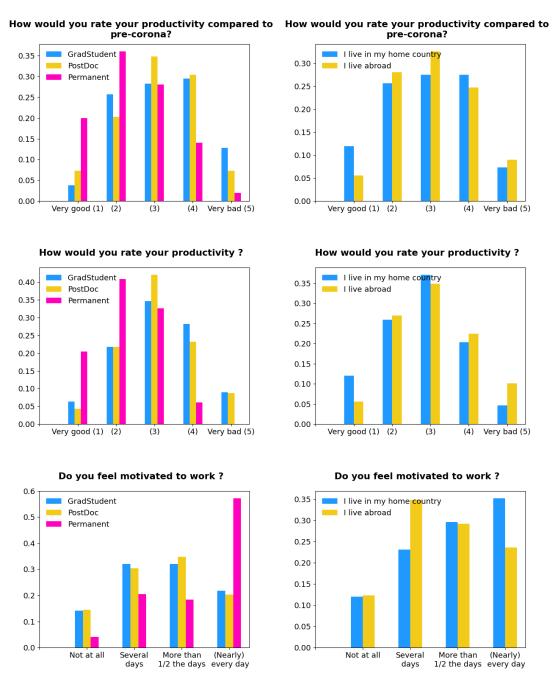


Figure 16: Respondents' self-assessment of productivity, compared to before the Covid-19 pandemic and their motivation levels split by position and living situation.

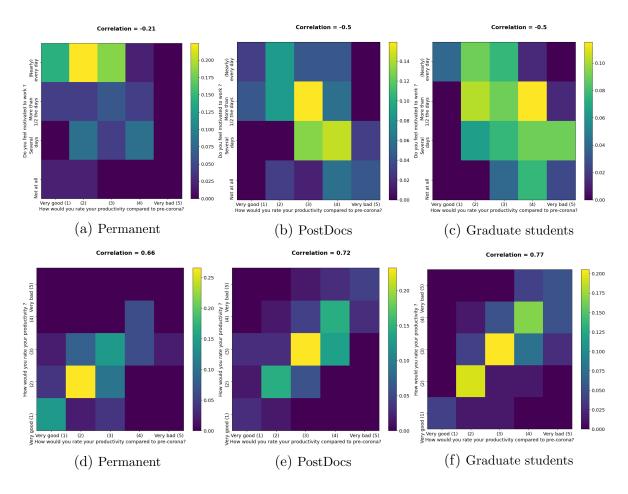


Figure 17: Respondents' motivation levels correlated with their self-assessment of productivity in general and of productivity compared to before the Covid-19 pandemic and their motivation levels split by position.

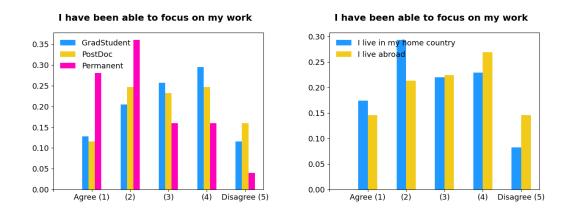


Figure 18: Respondents' ability to focus on work split by position and living situation.

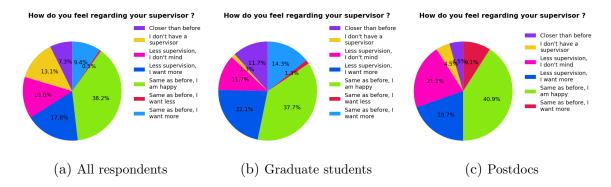


Figure 19: Respondents' feeling towards level of supervision during Covid-19 situation.

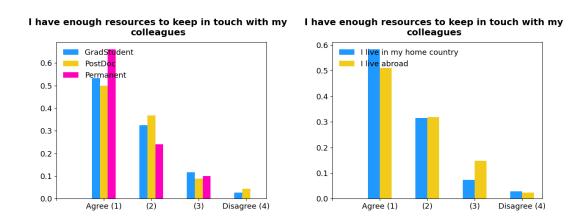


Figure 20: Respondents' satisfaction with resources to communicate split by position and living situation.

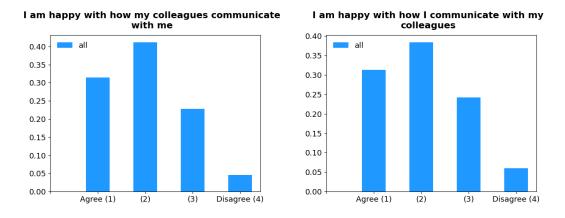


Figure 21: Communication between respondents and their colleagues. On the left, the satisfaction of respondents' communication with their colleagues, on the right the satisfaction of colleagues' communication with respondents.

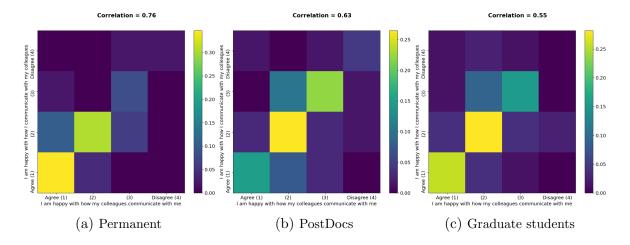


Figure 22: Respondents' satisfaction with communication between them and colleagues split by position.

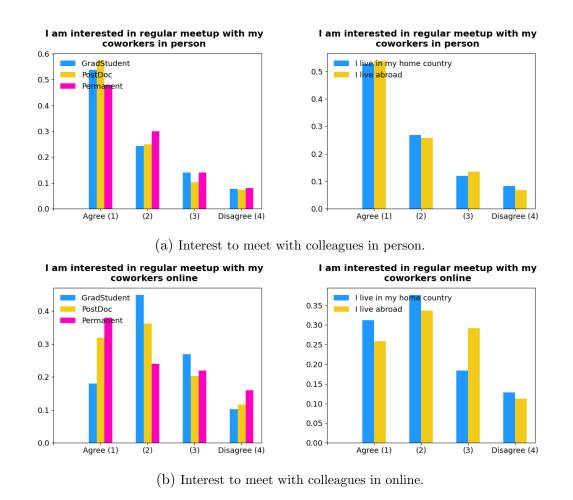


Figure 23: Respondents' interest to meet with colleagues split by position and living situation.

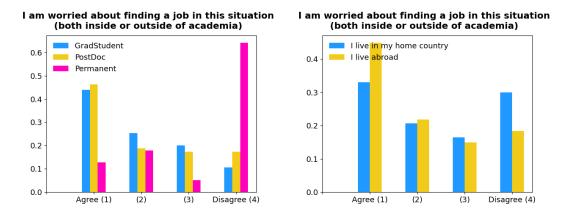


Figure 24: Respondents' level of concern with respect to finding a job inside or outside of academia during the Covid-19 situation split by position and living situation.

C Covid-19 related restrictions

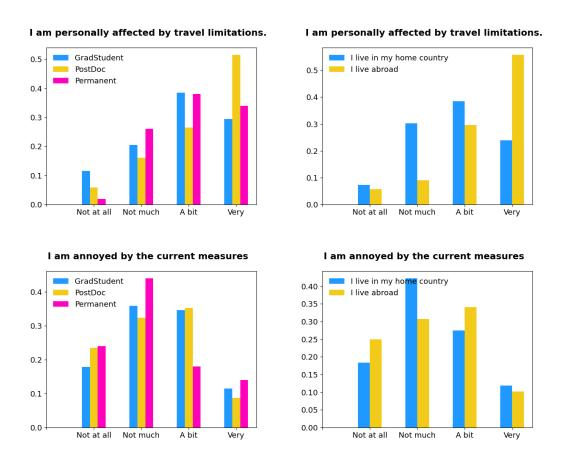


Figure 25: Impact of travel restrictions on respondents and their attitude towards current measures split by position and living situation.

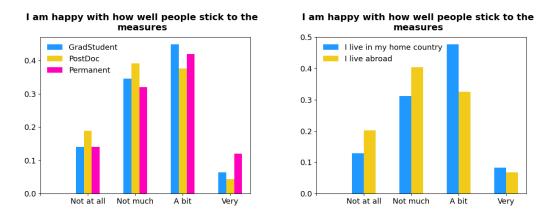


Figure 26: Respondents' satisfaction with how well others abide by Covid-19 restrictions split by position and living situation.

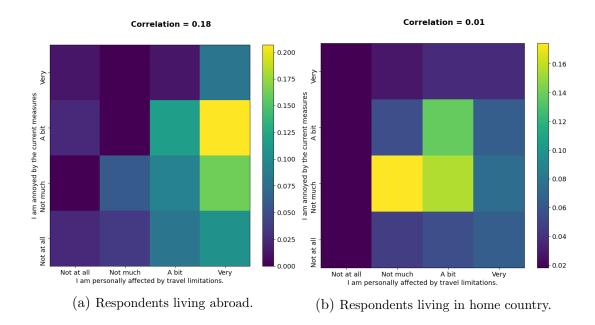


Figure 27: Impact of travel restrictions on respondents correlated with attitude towards current measures split by living situation.

D Physical health and quality of sleeping

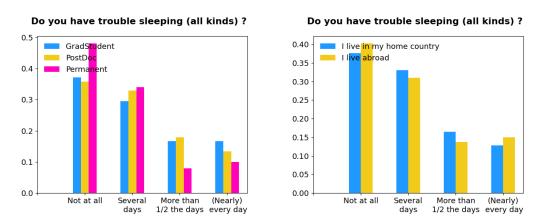


Figure 28: Respondents' ability to sleep well split by position and living situation.

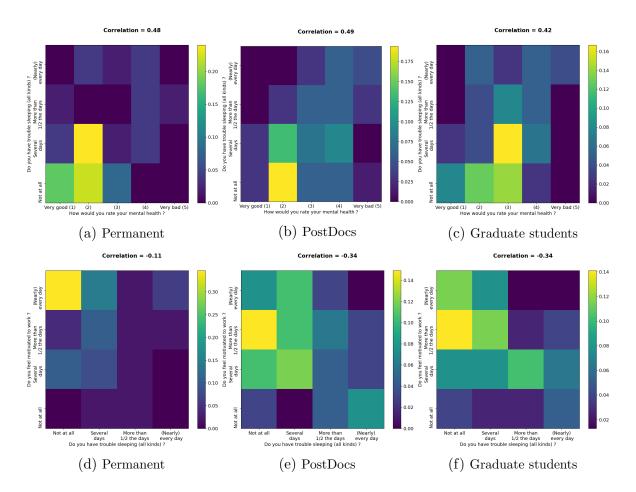


Figure 29: Respondents' ability to sleep well correlated with their self-assessment of mental health (top) and productivity (bottom) split by position.

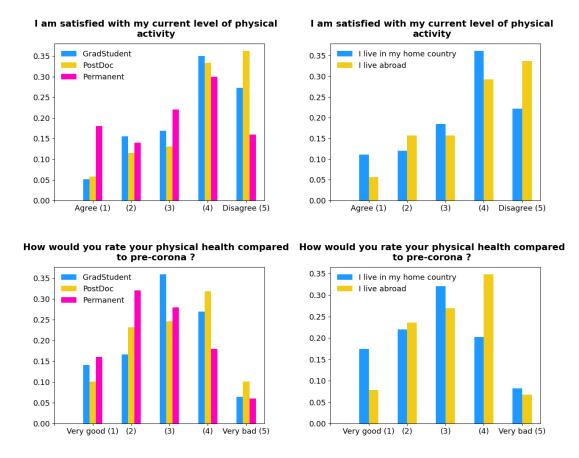


Figure 30: Respondents' satisfaction with current level of physical activity and their self-assessment of physical health compared to before the Covid-19 pandemic split by position and living situation.

E Stress and anxiety

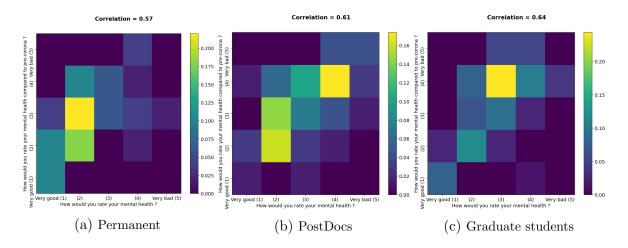


Figure 31: Respondents' self-assessment of mental health correlated with their self-assessment of mental health compared to before the Covid-19 pandemic split by position.

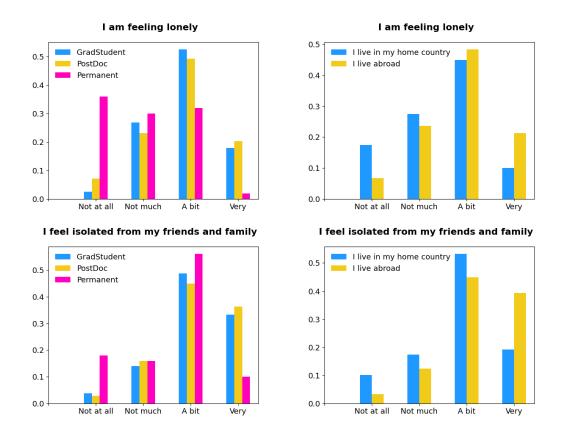


Figure 32: Respondents' feelings of isolation and loneliness split by position and living situation.

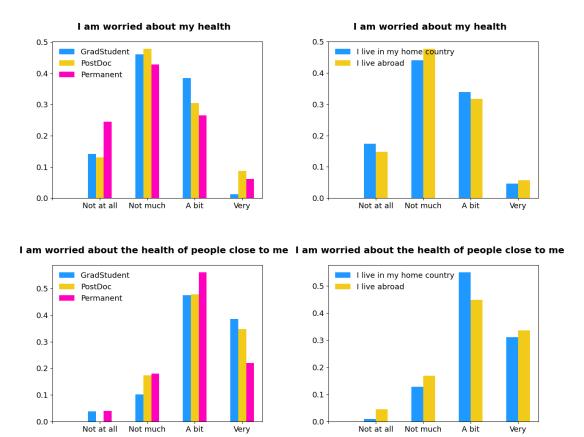


Figure 33: Respondents' concern for their own health and the health of loved ones split by position and living situation.

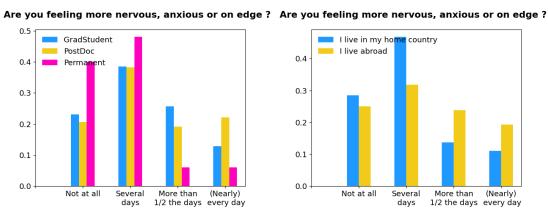


Figure 34: Respondents' feelings of nervousness and anxiety split by position and living situation split by position and living situation.

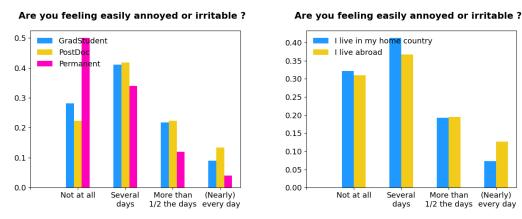


Figure 35: Respondents' feelings of irritability and annoyance split by position and living situation

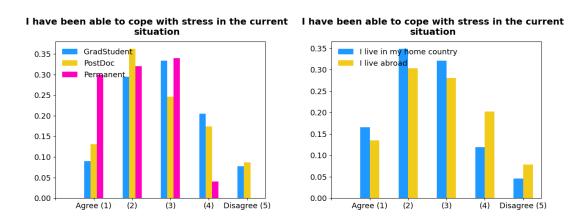


Figure 36: Respondents' ability to cope with stress of the Covid-19 situation split by position and living situation.

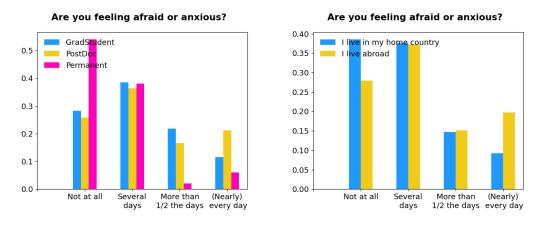


Figure 37: Respondents' feelings of fear and anxiety split by position and living situation

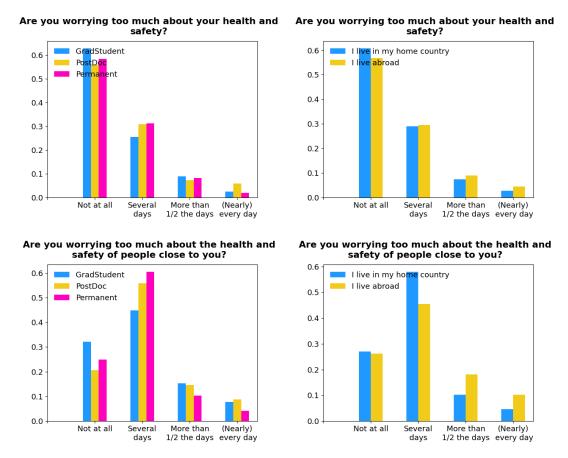


Figure 38: Respondents' interpretation of their feelings of worry towards their own and their loved ones' health and safety split by position and living situation.

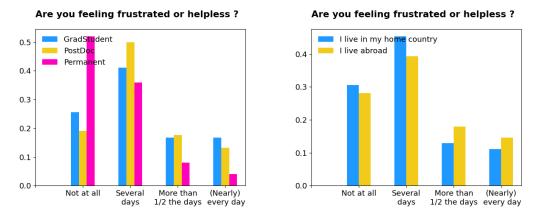


Figure 39: Respondents feeling frustrated or helpless split by position and living situation.

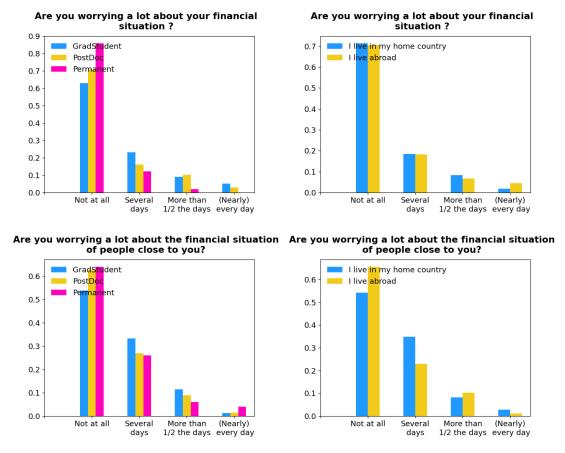


Figure 40: Respondents' feelings of worry about their own and their loved ones' financial situation split by position and living situation

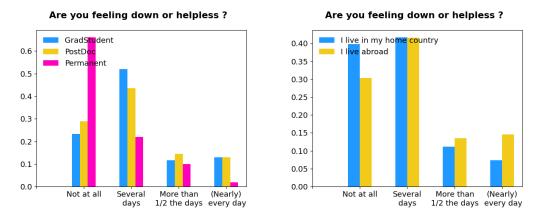


Figure 41: Respondents feeling down or helpless split by position and living situation.

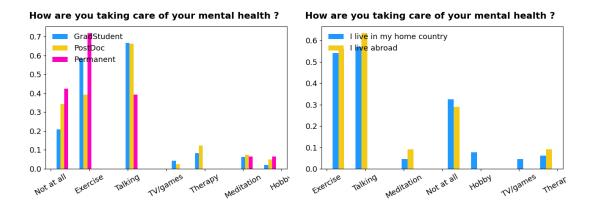


Figure 42: Respondents' actions to take care of their mental health split by position and living situation.

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