RSCA COVID-19 Research Impacts Survey: Preliminary Report

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Executive Summary

During December 2020 and January 2021, the University Senate's RSCA committee fielded a survey to all research-active faculty, staff, and doctoral students regarding the impact of the COVID-19 pandemic on their research activities. Preliminary results from that survey indicate that research disruption was widespread; that COVID-19's impact on research was felt primarily through its impact on researchers ability to travel, increased teaching demands, and family responsibilities; and that utilization of Penn State's COVID-19-related resources to facilitate research during the pandemic was moderate.

Introduction

In September of 2020, the Research, Scholarship, and Creative Activities (RSCA) Committee of the Penn State University Senate was charged *inter alia* with assessing the impact of the COVID-19 pandemic on research activities at the University. After some discussion, the committee elected to administer a survey to research-active members of the Penn State community, as one means of assessment.

This report briefly summarizes the results of that survey. Please note that *this is a preliminary report*; in addition to incorporating additional data from the upcoming Fall 2021 administration of the survey, the full report will contain additional analyses of the data examined herein.

The Survey

Professor Christopher Zorn (College of Liberal Arts) worked with Geoffrey Mamerow (Office of Planning, Assessment, and Institutional Research) to draft and administer a 16-item survey. The survey was administered on-line, using the Qualtrics platform. The sampling pool was all research-active faculty, staff, and graduate students (including postdoctoral scholars) at all Penn State campuses. Zorn and Mamerow worked with Drs. Kathy Bieschke (Vice Provost for Faculty Affairs) and Lora Weiss (Sr. Vice President for Research) to obtain a list of all such individuals, and Dr. Bieschke sent survey invitations to a total of 10924 members of the Penn State research community, and a reminder to fill out the survey appeared in Dr. Bieschke's biweekly "News for Faculty and Instructors: Penn State and COVID-19" emails beginning on December 11, 2020.

The survey asked individuals the extent to which research comprised an important part of their professional activities at Penn State. It then asked each respondent to score their research productivity between March 1 and October 31, 2019 on a scale ranging from 0 (lowest) to 100 (highest), and then to do the same thing for the period from March 1 to October 31, 2020. Depending on the respondent's answers to these question, they were then asked to indicate the reason(s) for the decline (or increase) in their research activity. The survey went on to ask respondents about their utilization of some of the resources that Penn State had made available to facilitate research during the COVID-19 pandemic, and then to ask a series of open-ended items in which respondents could offer additional comments on how COVID-19 had impacted their research, and suggestions for how Penn State could minimize the negative impact of the pandemic on research. Those questions were followed by a battery of demographic questions which concluded the survey. The full text of the RSCA COVID-19 Research Impacts survey can be found *here*.

The survey went into the field on December 9, 2020, and was available for respondents until January 25, 2021. During that time, a total of 3056 responses were received, 1946 of which were complete and provided usable data.[1] There were 10924 invitations to respond to the survey sent out, yielding an overall response rate of approximately 28 percent, and a valid response rate of 17.8 percent. Figure 1 illustrates the patterns of item-level nonresponse within the 1946 valid surveys received. The highest levels of item-level nonresponse were to demographic questions about income, race, family status, and sexual orientation.

[1]The frequency distribution of survey responses by week is presented in the Appendix.

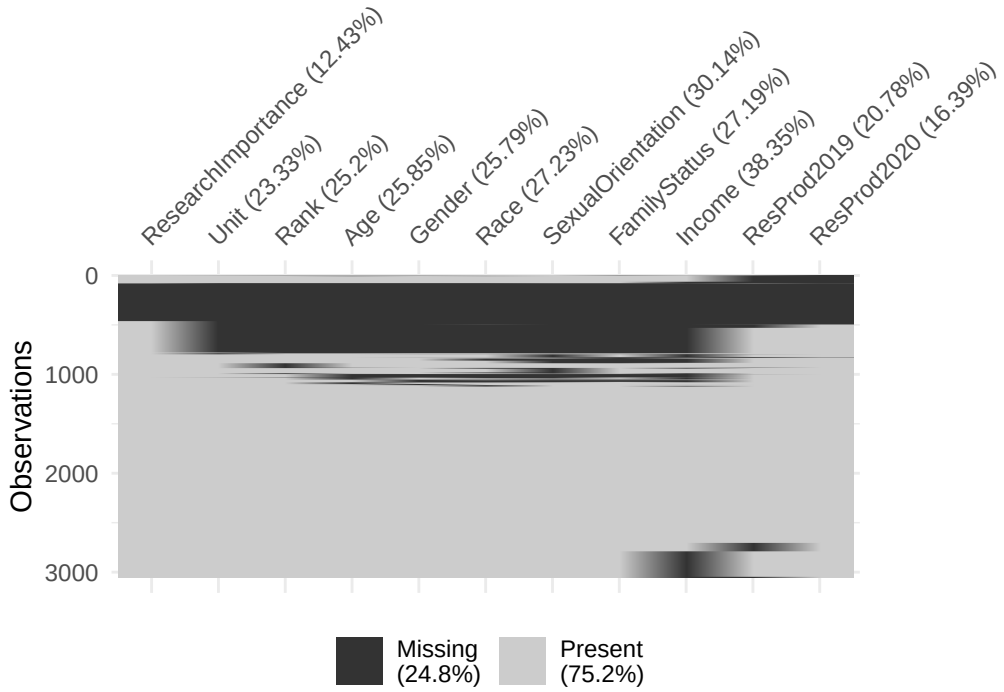

Figure 1: Response Patterns and Missingness

Respondent Characteristics

We begin with some descriptive results for the survey respondents. Figure 2 illustrates the campus units with which each respondent was associated. Unsurprisingly, seven of the top 10 units with the largest numbers of respondents were at University Park (UP); collectively, 1635 of the 3056 total responses in the data were from units located at UP (a figure which does not include individuals in University Libraries).

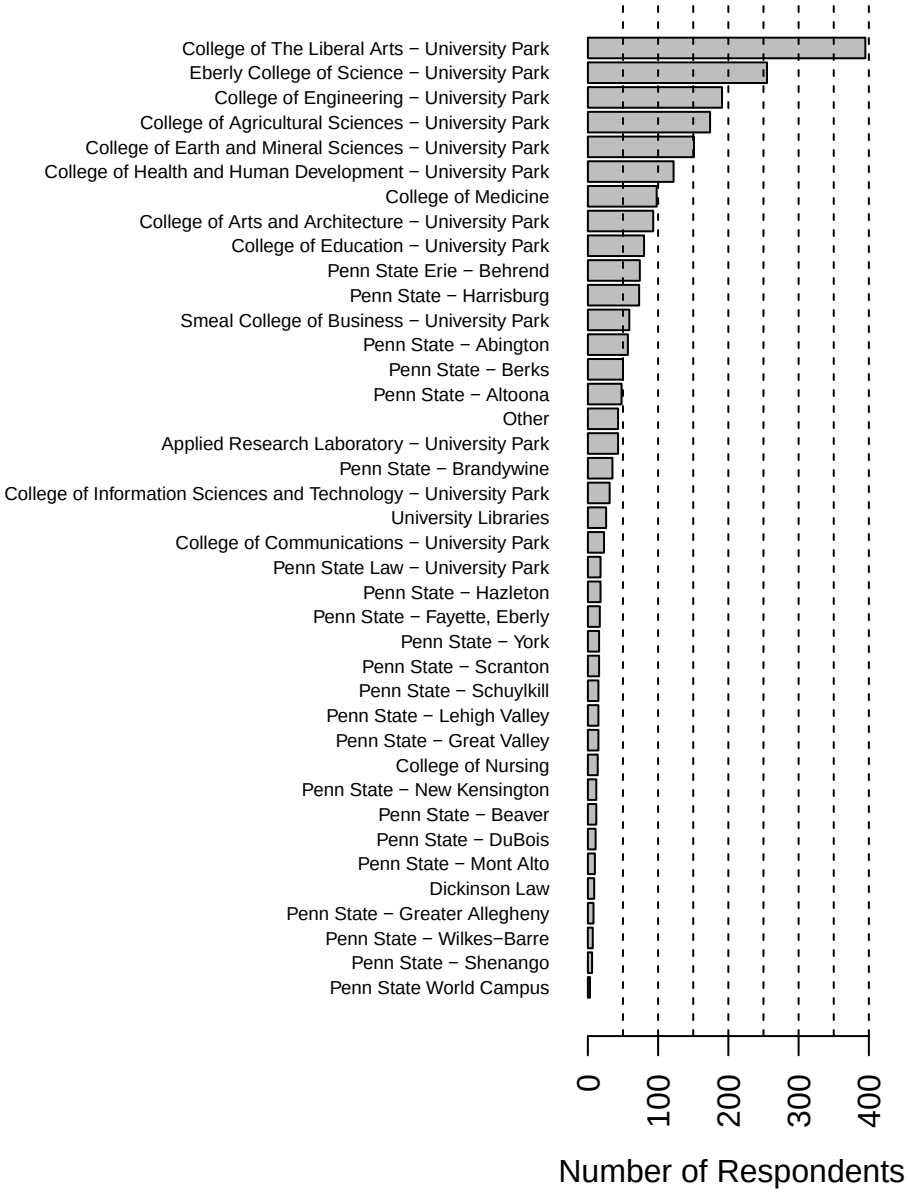

Figure 2: Respondent Campus Units

Figure 3 illustrates the ranks roles of survey respondents. Across all units, the most common respondents were doctoral students and tenure-line faculty, who together comprised roughly half of the total number of respondents. Figure 4 provides the same respondent frequencies for the survey's *Age* categories.

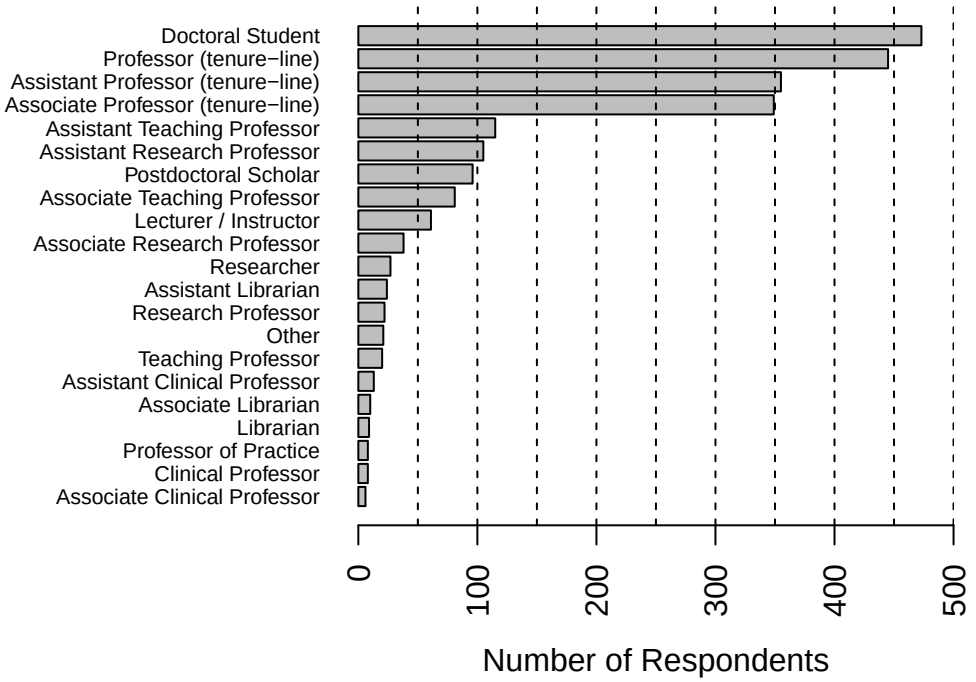

Figure 3: Respondent Ranks

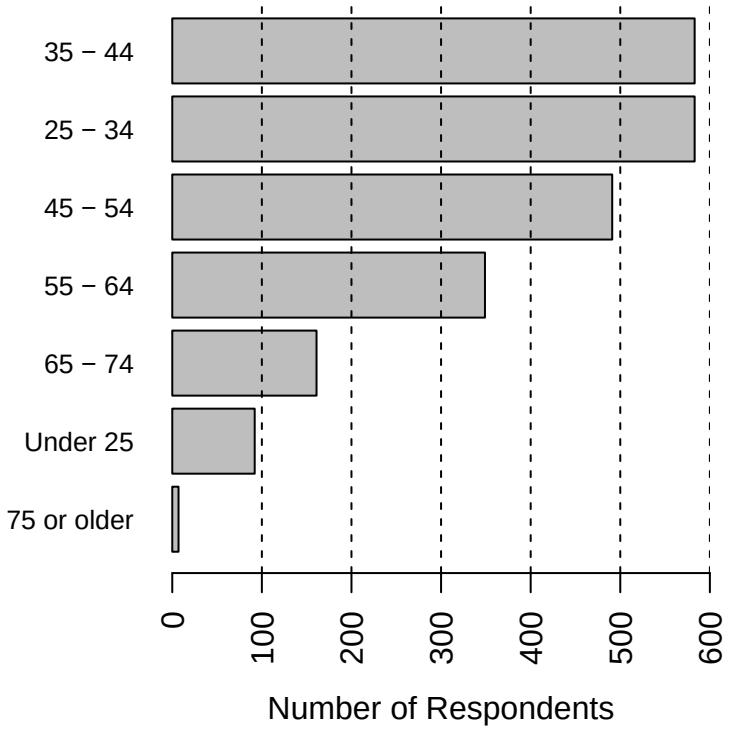

Figure 4: Respondent Ages

Figure 5 provides frequencies for respondents' self-reported gender identification, and Figure 6 does the same for respondent's racial / ethnic identification. Among respondents, self-identified men outnumbered women by a slight amount (50.7 to 48 percent), while respondents were predominantly (71 percent) white, with individuals identifying as Asian comprising the next largest group (16.3 percent).

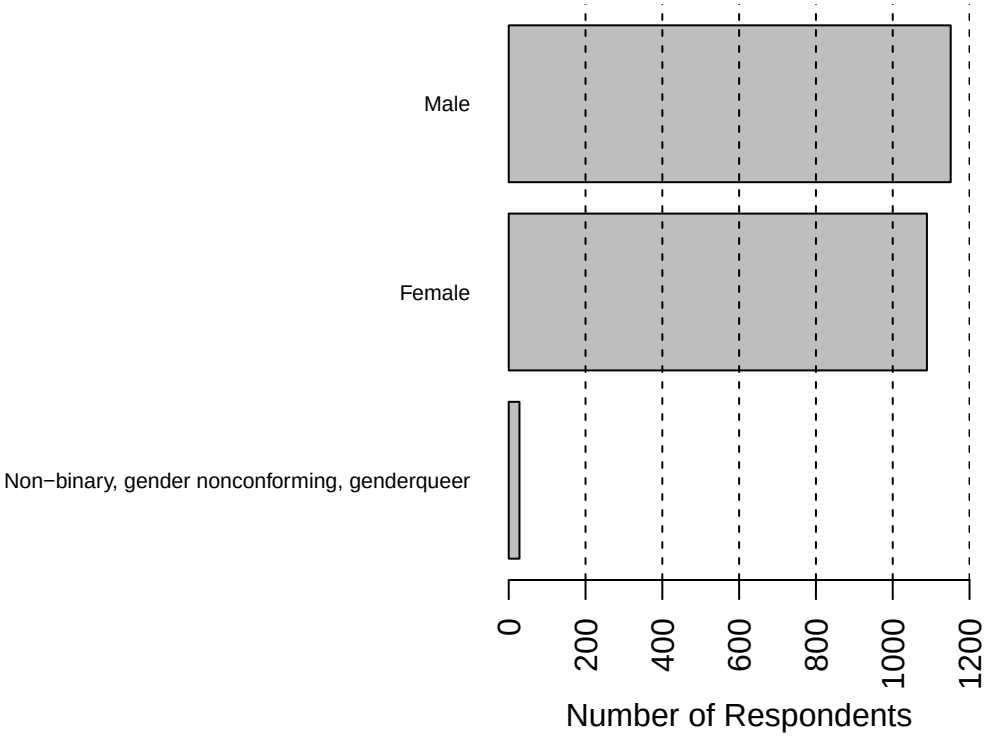

Figure 5: Respondent Gender

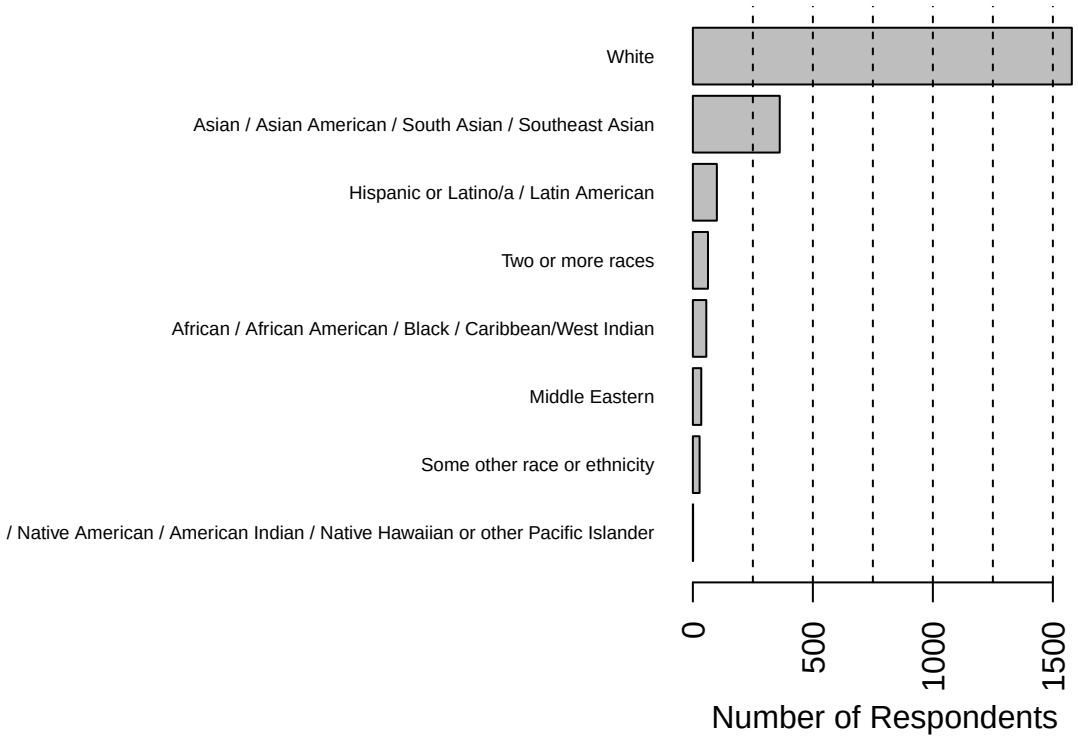

Figure 6: Respondent Race/Ethnicity

The final three descriptive figures show the number of survey respondents for groups defined by the survey's *Sexual Orientation*, *Family Status*, and *Income* variables. Perhaps unsurprisingly, a large majority of respondents reported their sexual orientation as straight / heterosexual (85.6 percent). Respondents who were married and had children living at home (42.2 percent of respondents) were the largest group, with childless married (26.6) and single (25.1) individuals the next-largest groups. With respect to income, those reporting household incomes of $100,000-150,000 were the largest group in the data (20.9 percent of respondents).

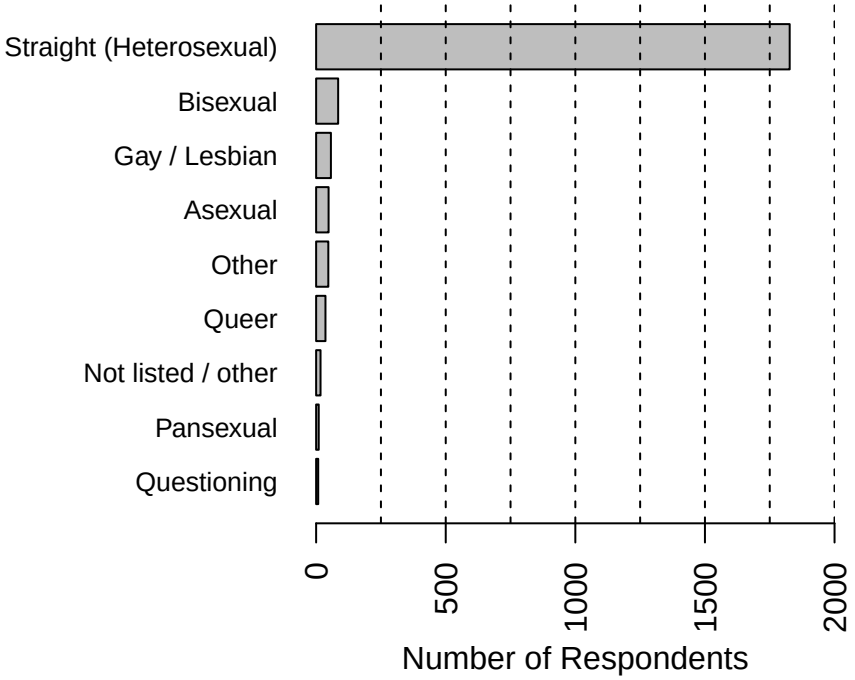

Figure 7: Respondent Sexual Orientation

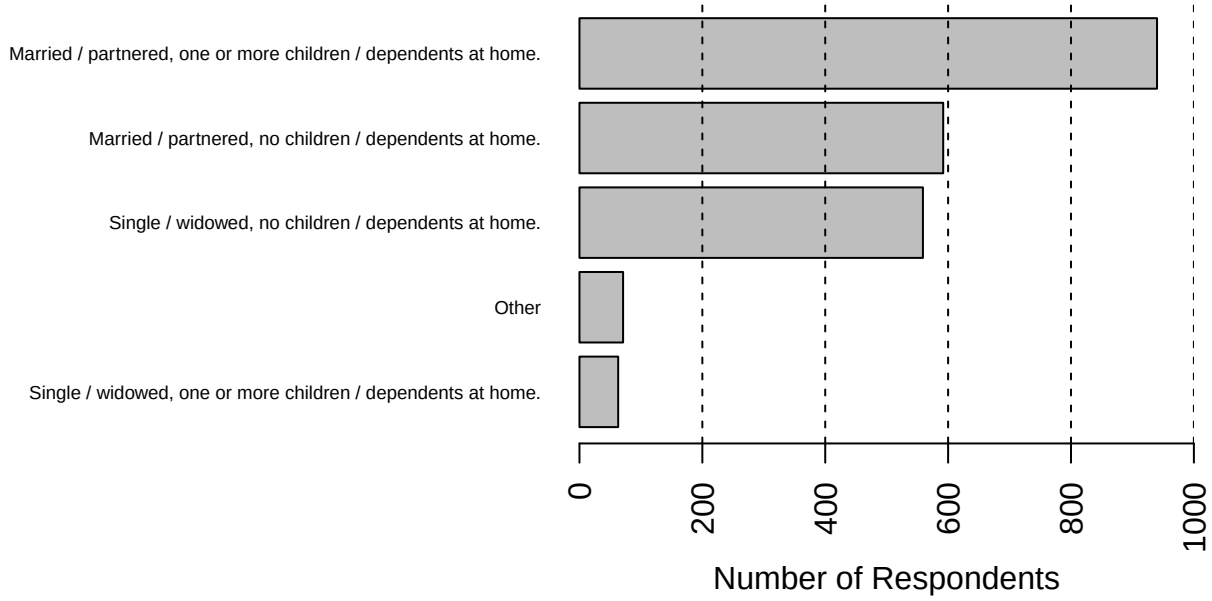

Figure 8: Respondent Family Status

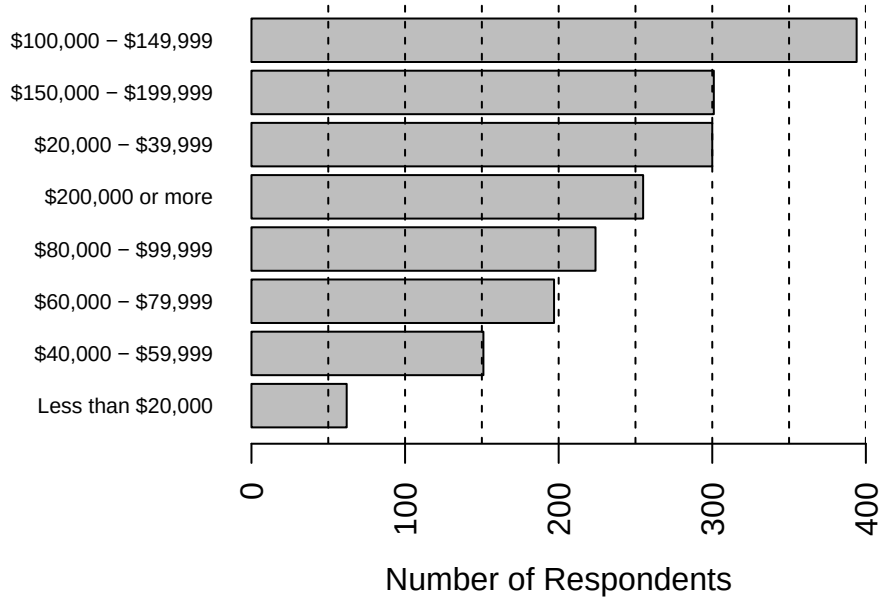

Figure 9: Respondent Income

Research Importance

As noted above, respondents were first asked about the importance of research activities to their professional roles at Penn State. Figure 10 illustrates the marginal frequencies for responses to that question, ranked in order of prevalence. A plurality but not a majority (47.1 percent) of respondents indicated that research is a "very important" part of their professional responsibilities, with those listing research as "sole" or "co-equal" responsibilities being the next most-frequently chosen options. Regression analyses (not shown) indicate that a number of respondent characteristics are positively associated with research having higher importance, including some ranks (tenure-line and research faculty, and graduate students) and family status (single without children and "other"), while negative marginal associations with research importance were observed for older respondents. Holding other variables constant, there were no significant differences in research importance across gender, sexual orientation, or racial categories.

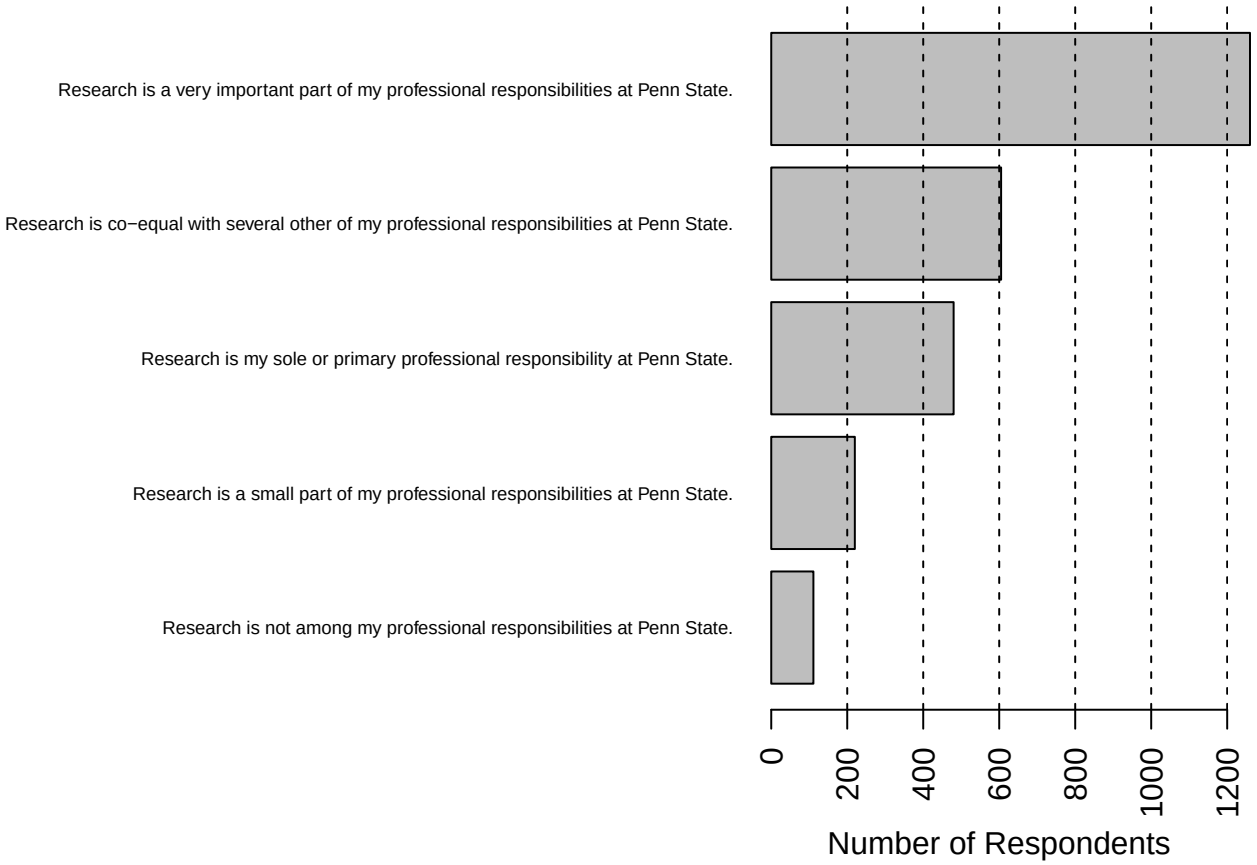

Figure 10: Research Importance

Research Productivity

As mentioned above, the survey asked individuals to report on their research productivity during 2019 and 2020. For purposes of the survey, respondents were instructed to define "research" to be those activities which fall under the category of "The Scholarship of Research and Creative Accomplishments" in University Policy AC23. These include:

> "...competence, usually demonstrated through publication, exhibition, performance, or presentation of scholarly papers, to carry out research or creative work of high quality and scholarly significance... evidence of thorough understanding of the field; maintenance of high levels of academic performance; recognized reputation in the subject matter field; evidence of continued professional growth and active contribution to professional organizations."

Figure 11 shows kernel density plots for the responses to the research productivity items for 2019 and 2020 for all respondents in the survey with valid responses ($N = 2421$). In an unsurprising result, the data indicate that, on average, respondents' research productivity decreased between March-October 2019 and the same period in 2020. Both median (80 vs. 47) and mean (73.538 vs. 46.424) levels of productivity saw substantial declines; moreover, as Figure 11 illustrates, 2020 also saw an increase in the variability of the responses (s.d. = 25.563 for 2020, vs. 23.045 for 2019). It is also notable that the substantial left-skewness of the distribution for 2019 (μ_3 = -1.369) disappears during 2020 ($\mu_3 = 0.145$). While it is impossible to establish that these decreases were a direct result of the COVID-19 pandemic, given the pandemic's scale and seriousness, it is likely that it played at least some role in those declines.

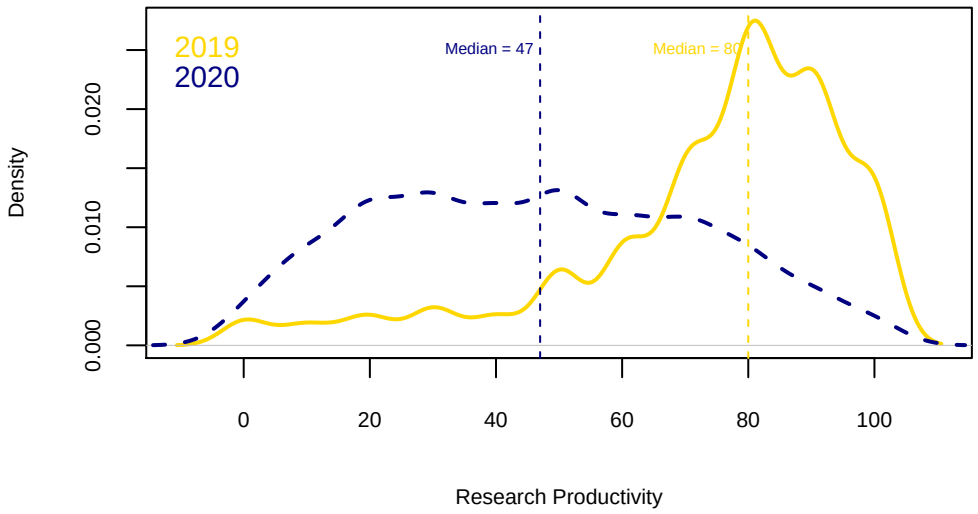

Figure 11: Density Plots: Research Productivity

While a full analysis of the research productivity numbers – including those obtained in the upcoming Fall 2021 survey – remains to be conducted, below we begin to explore some of the correlates of the changes observed. Figures 12-15 plot *differences* between respondents' self-reported research productivity scores for the two years surveyed. Scores are calculated as $Productivity_{2020} - Productivity_{2019}$ such that negative values indicate declines in research from 2019 to 2020 while positive values indicate increases. All these plots have a solid vertical line at zero, for reference.

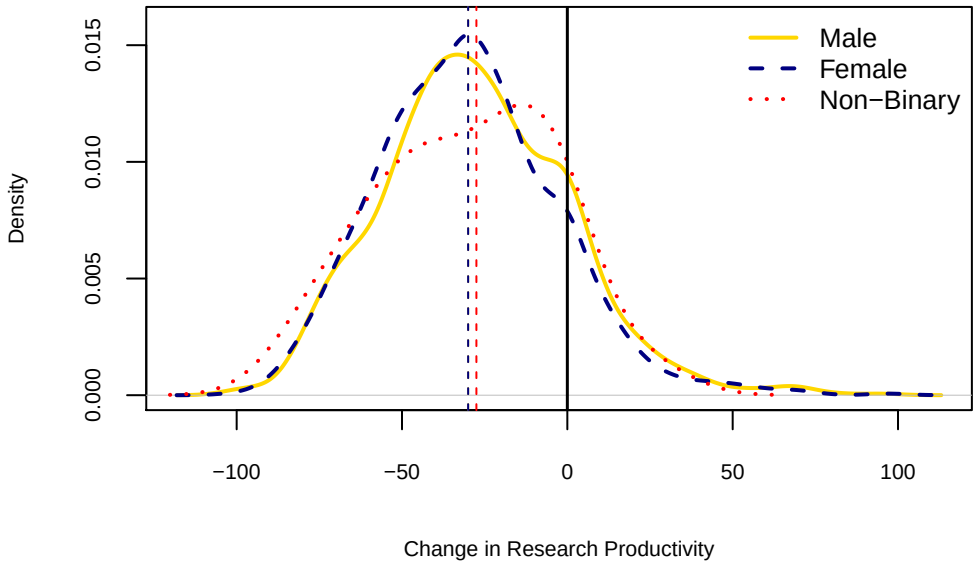

Figure 12: Change in Research Productivity by Gender

Figure 12 shows kernel density plots of those productivity differences by respondent gender self-identification. Most striking is that there are essentially zero differences across gender categories, either in terms of typical values (group medians, indicated by vertical dashed lines, equal -30, -30, and -27.5 for male-, female-, and non-binary-identifying respondents, respectively, and ANOVA yields $F = 2.299$, $P = 0.101$) or in the overall shape of the distributions of those differences. While the small number of non-binary-identifying respondents ($N = 26$) makes drawing conclusions about that subpopulation challenging, these initial bivariate results suggest few aggregate differences in research productivity across gender categories.

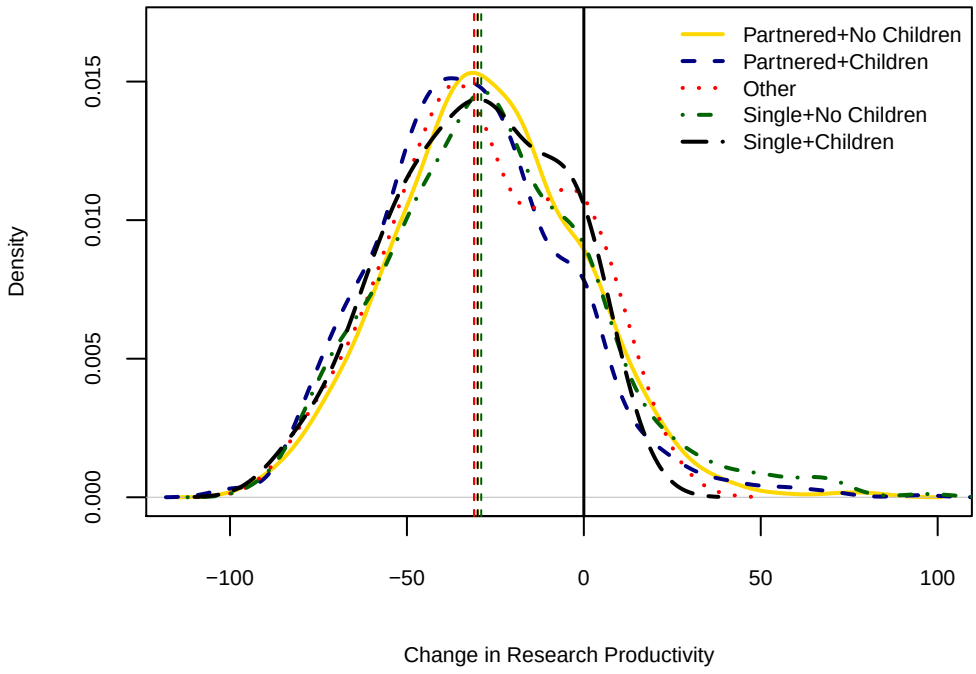

Figure 13: Change in Research Productivity by Family Status

Figure 13 mimics Figure 12, showing kernel density plots of research productivity differences by respondents' family status. Once again, we see few important differences, either in the median values of the distributions (which equal -30, -31, -31, -29 and -30 for the listed groups, respectively) or in their overall patterns. ANOVA ($F = 4.21$, $P = 0.002$) indicates that the differences in mean values, while small, are statistically significant. While the figure illustrates some slight differences in the shapes of the distributions – for example, the distribution for single + childless respondents exhibits the greatest observed variance of the five – in general the clear conclusion is that there are few important differences in research productivity shifts across groups defined by family status.

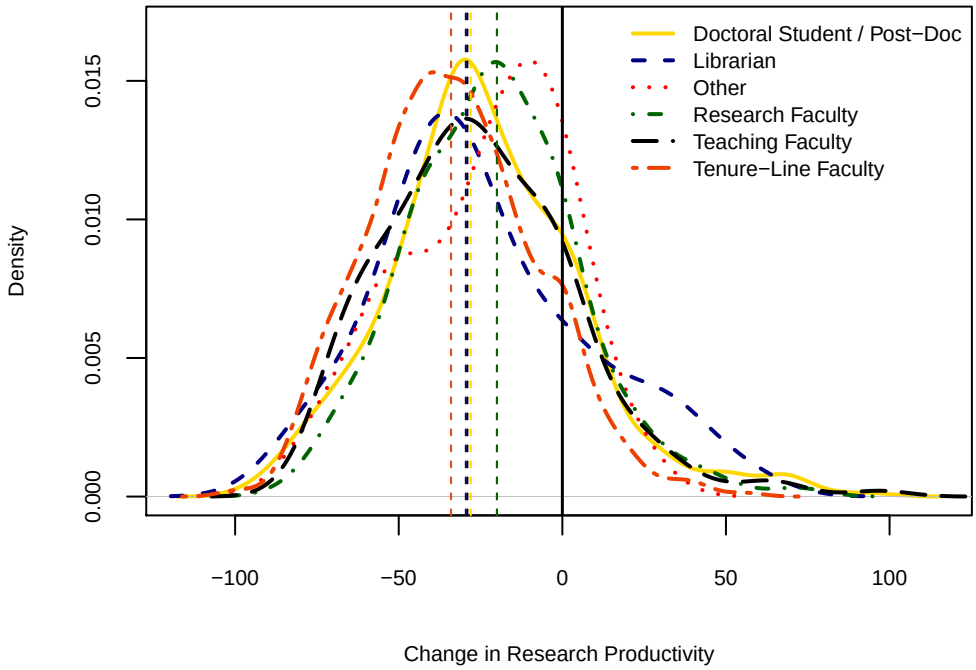

Figure 14: Change in Research Productivity by Role/Position

We present a similar plot for respondent roles in Figure 14. To ensure sufficient data and clarify presentation, respondents were grouped into six categories: Doctoral Student / Post-Doc, Librarian, Other, Research Faculty, Teaching Faculty, and Tenure-Line Faculty. In contrast to the previous two figures, Figure 14 illustrates substantial differences in research impacts across roles. By a significant margin, the largest average decreases in research productivity were seen by tenure-line faculty (median decrease = -34, mean decrease = -33.26). Other median decreases were less, with the smallest median decrease of -20 occurring among Librarians and Research Faculty, and the largest (of -29.5) among Librarians. ANOVA results ($F = 13.823$, $P = 2.613 \times 10^{-13}$) indicate that the differences across these groups are unlikely to be attributable to chance. Once again, the distributions of scores around their central values are generally normal.

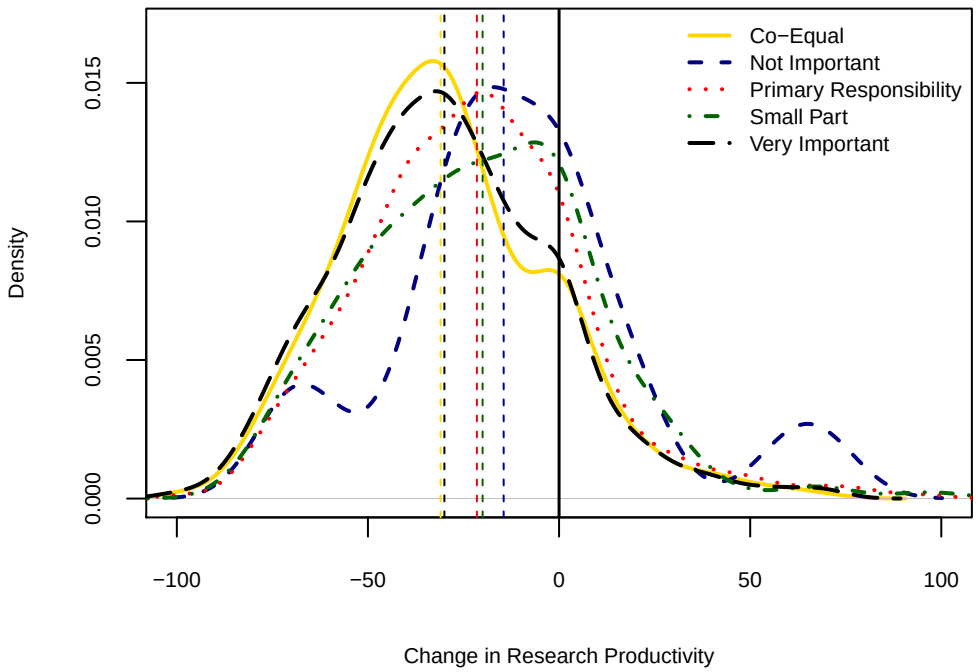

Figure 15: Change in Research Productivity by Research Importance

Finally, Figure 15 plots the distributions of changes in research productivity scores by the importance of research to respondents' professional responsibilities at Penn State. Similar to Figure 14, we observe important differences in the median levels of declines between 2019 and 2020, with the highest median decreases reported among respondents for whom research was co-equal with other responsibilities (median = -31) and those for whom research is a very important part of their professional responsibilities (median = -30). Perhaps unsurprisingly, the smallest median decreases (of median = -14.5) were exhibited among respondents who indicated that research was not a part of their professional responsibilities. These differences are statistically significant at conventional levels ($F = 10.311$, $P = 2.804 \times 10^{-8}$).

In addition to the results in Figure 12-15, bivariate analyses were also conducted to detect differences in research productivity by other categories. These analyses showed slight but significant differences in those changes by reported income category ($F = 5.242$, $P = 6.203 \times 10^{-6}$), with the smallest average decreases reported among respondents earning between $40,000 and $60,000 per year. They also indicated that there were a few important differences by respondent age ($F = 8.19$, $P = 8.907 \times 10^{-9}$), with the smallest decreases in research productivity reported among respondents over the age of 75, and the largest among those between ages 35 and 44. Finally, a comparison across units/locations (aggregated to three categories: University Park, Hershey, and all others) shows no important differences in

average changes in research productivity across those locations ($F = 0.401$, $P = 0.67$).[2]

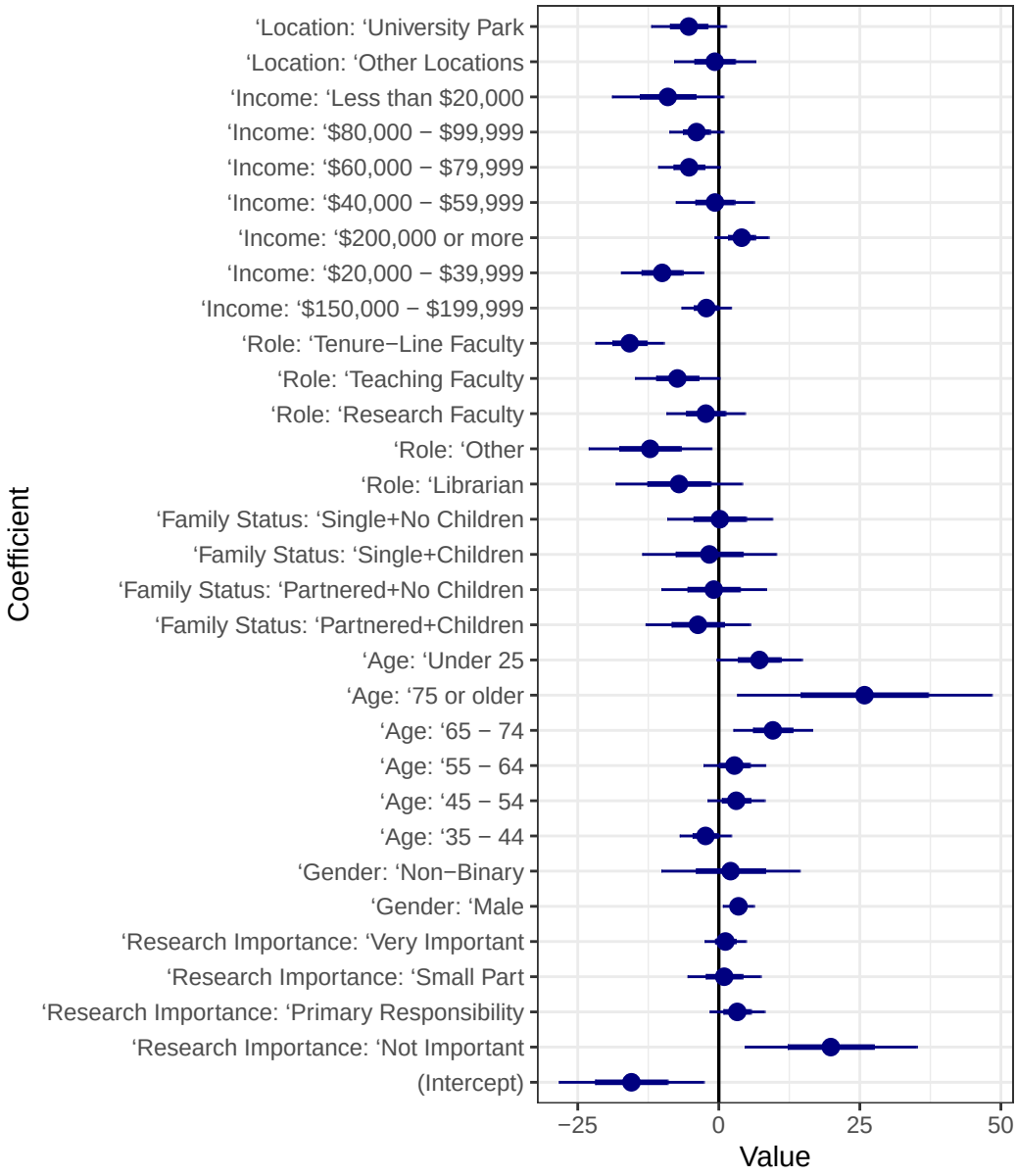

Figure 16: Correlates of Changes in Research Productivity

A preliminary multivariate analysis is presented in Figure 16, which plots the coefficient estimates (and 50 and 95 percent two-tailed confidence intervals) for a linear regression (R-squared $= 0.083$, $\sigma = 26.752$, $N = 1632$) of changes in research productivity on the set of respondent characteristics discussed above. Omitted / reference categories are Hershey (for *Location*), \$100,000-\$150,000 (for *Income*), doctoral student / post-doc (for *Role*), "Other" (for

[2]A plot of median changes in research productivity for the fully disaggregated variable indicating the respondent's campus or unit is presented in the Appendix.

Family Status), 25-35 (for *Age*), female (for *Gender*), and "co-equal" (for *Research Importance*). The multivariate analysis largely confirms the descriptive results above, revealing substantial differences in changes to research productivity across *Age*, *Role*, and *Research Importance* categories, but only slight differences for some income categories and no notable differences by gender or family status.

Reasons for Change

If respondents reported a decrease in research productivity between 2019 and 2020, they were asked which (if any) of nine different reasons they believed were responsible for that decline. Similarly, if respondents reported in an increase research productivity between 2019 and 2020, they were asked which (if any) of three general reasons they believed were responsible for that increase. In both cases, respondents were instructed to mark all reasons that applied to them.

Figure 17 reports frequencies for the reasons respondents listed for research declines. The most frequently-given reason was increased time spent on teaching, with limits to research-relate travel running a close second.

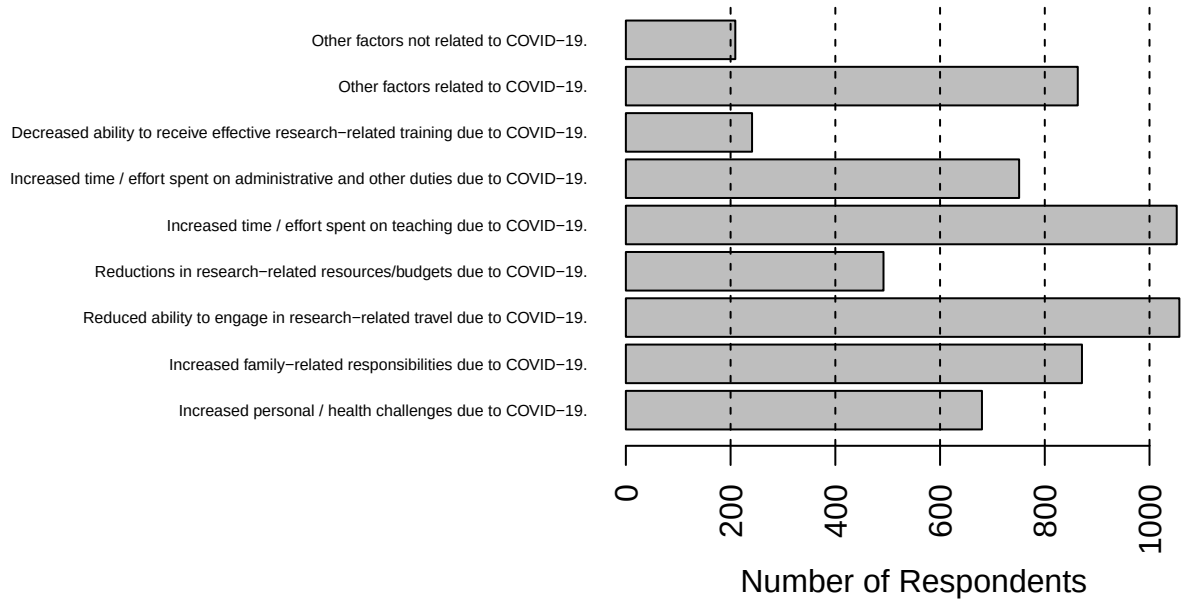

Figure 17: Reasons for Productivity Declines

Figure 18 presents (tetrachoric) correlations among the various reasons given; higher values correspond to pairs of reasons which had high frequencies of respondents who did (or did

not) indicate both such reasons in the survey. Notably, all such correlations are at least marginally positive, though they vary significantly in magnitude. The highest correlations were seen with the teaching item, which correlates strongly with those related to administrative duties, travel, and family-related challenges. The item related to travel also had the highest typical correlation with the other categories, further supporting the idea that limits on research-related travel were among the most widespread negative impacts of the pandemic.

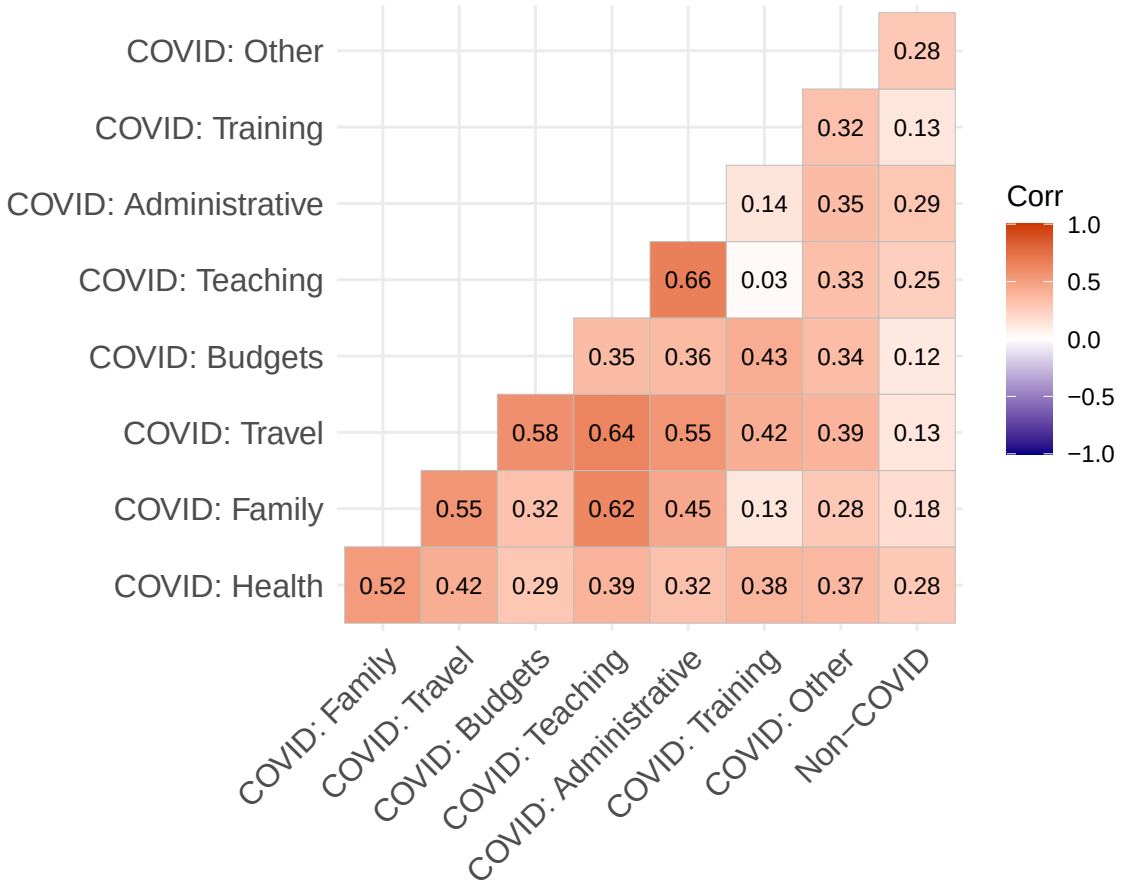

Figure 18: Correlations among Reasons for Productivity Declines

Figures 19 and 20 present similar analyses for the (more attenuated) list of reasons that respondents' research productivity *increased* from 2019 to 2020. Note that, as suggested by the figures above, the total number of respondents for whom productivity declined ($N = 2590$) was substantially greater than the number for whom research increased ($N = 954$); moreover, the average magnitude of decreases was significantly greater than that of increases (-37.3 vs. 20.613, respectively).

As seen in Figure 19, the more frequently-reported reason for productivity increases was

factors unrelated to COVID-19, a result that is in stark contrast to Figure 17 above (where non-COVID factors was the *least* frequently mentioned reason for productivity declines). The correlations among the three possible reasons in Figure 20 are also generally higher than those seen in Figure 18.

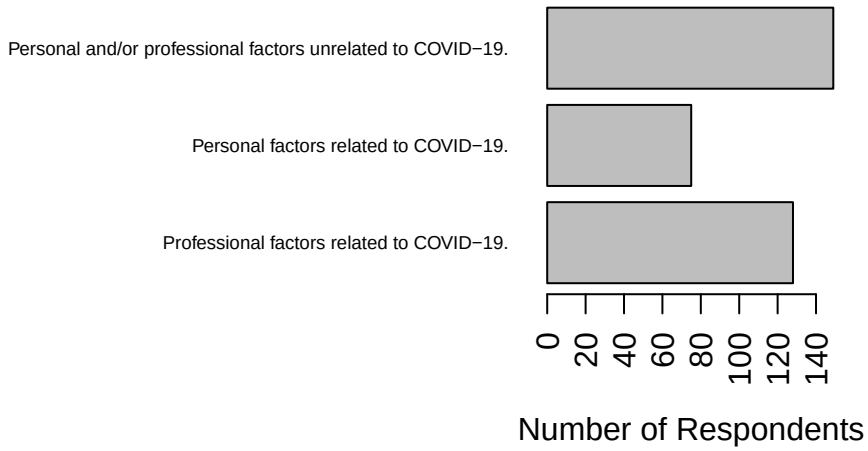

Figure 19: Reasons for Productivity Increases

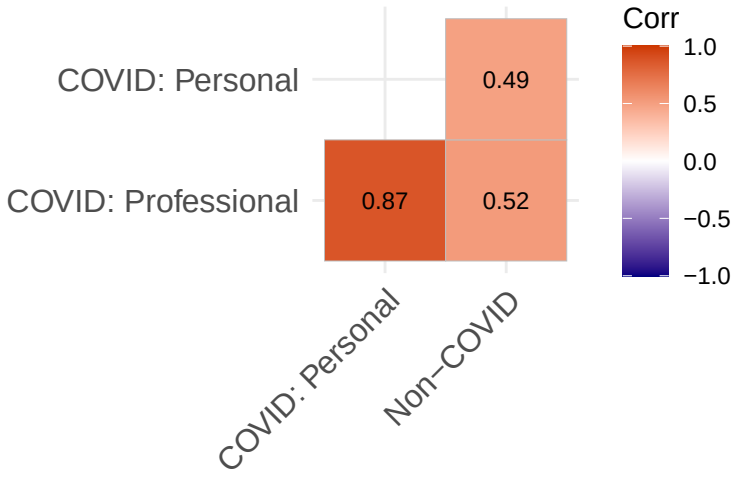

Figure 20: Correlations among Reasons for Productivity Increases

Utilization of Penn State's COVID Response Resources

The final substantive quantitative question on the survey listed seven research-related responses that Penn State implemented to mitigate the pandemic's impact on research, and asked respondents to indicate which (if any) of those resources they had utilized. The full descriptions of those resources are available in the survey instrument.

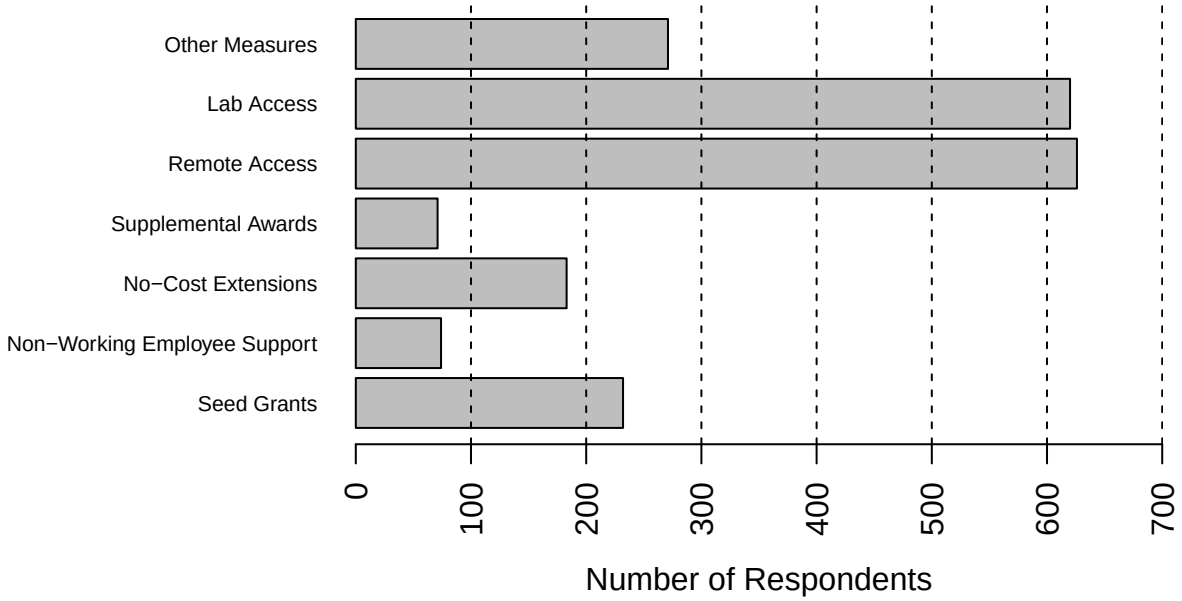

Figure 21: Use of Penn State COVID Response Resources

Figure 21 illustrates the frequencies with which respondents used the mentioned resources. In total, 1355 of the survey's 3056 respondents (44 percent) of respondents reported using at least one of the resources available. The most frequently mentioned were "(T)he availability of remote access to core research facilities, and upgraded with hardware and software to support remote research" and "the ability for undergraduate students and graduate students to continue working in labs and other facilities, albeit at a reduced level." Similar to above, the correlations among the various resources are presented in Figure 22.

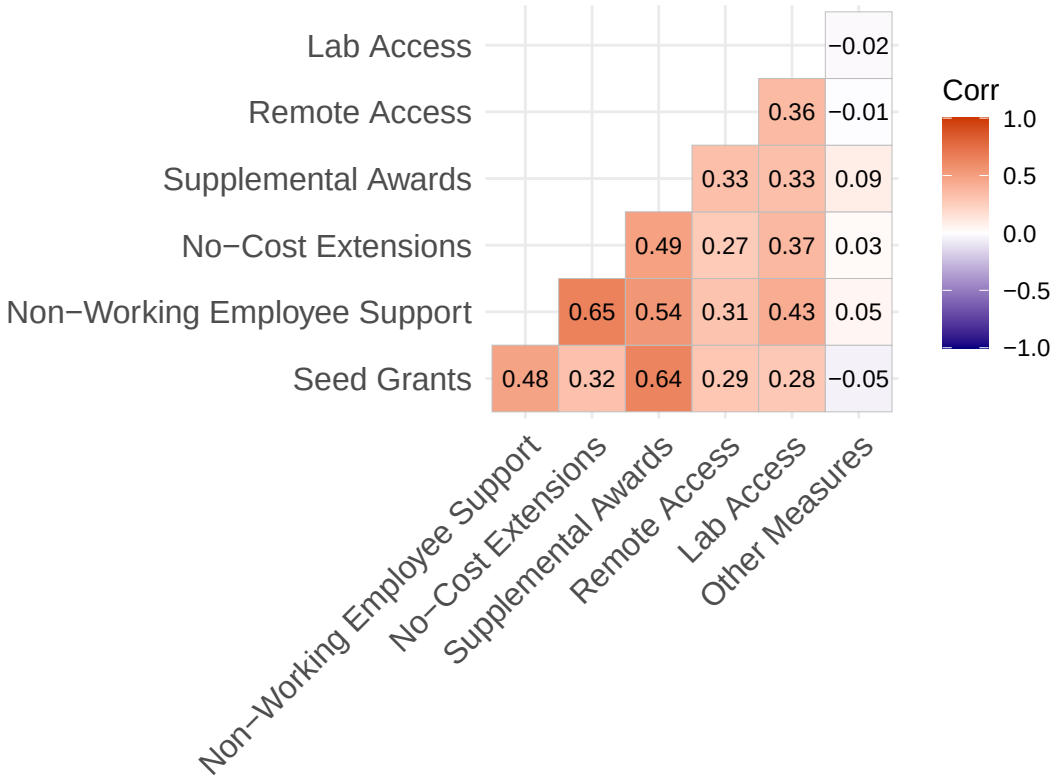

Figure 22: Correlations among Resources Used

Open-Ended Questions

The survey concluded with two open-ended (text box) questions, in which respondents were asked to provide additional information about how COVID-19 had impacted their research, and to offer suggestions for how Penn State could better support research during the pandemic. At the time of this preliminary report, the data from those open-ended questions have not yet been analyzed.

Additional Work

As noted at the outset, this report is preliminary. Additional information from the Fall 2021 RSCA COVID-19 research survey will be incorporated into the Committee's full report. In addition, the preliminary findings herein suggest a range of possible future directions for analysis. A partial list of those includes:

- Disaggregated analyses by unit/campus, subject to constraints to ensure that reverse-identification of survey respondents is not possible.
- Additional multivariate analyses, with particular attention to relaxing the implicit

assumption of parameter homogeneity (for example, by incorporating interactions between gender and family status).

- Examination of patterns of correlations among the reasons given for research changes, with particular attention to disaggregating by gender, rank, and family status. Despite the lack of mean-level differences in productivity across many of those categories, it is unlikely that the web of reasons for COVID's impact on research would be the same for (e.g.) doctoral students vs. tenure-line faculty. Similar differences are likely to hold across other demographic categories.
- Linguistic and content analyses of the survey's open-ended items, to provide additional richness to the findings herein.

Appendix: Supplementary Figures and Tables

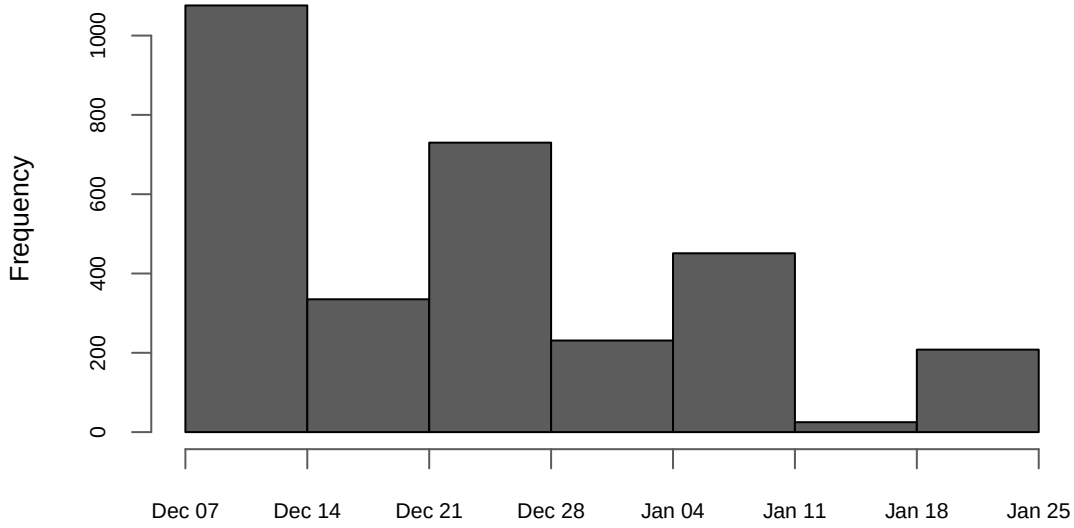

Figure 23: Response Frequencies By Week, 2020-21

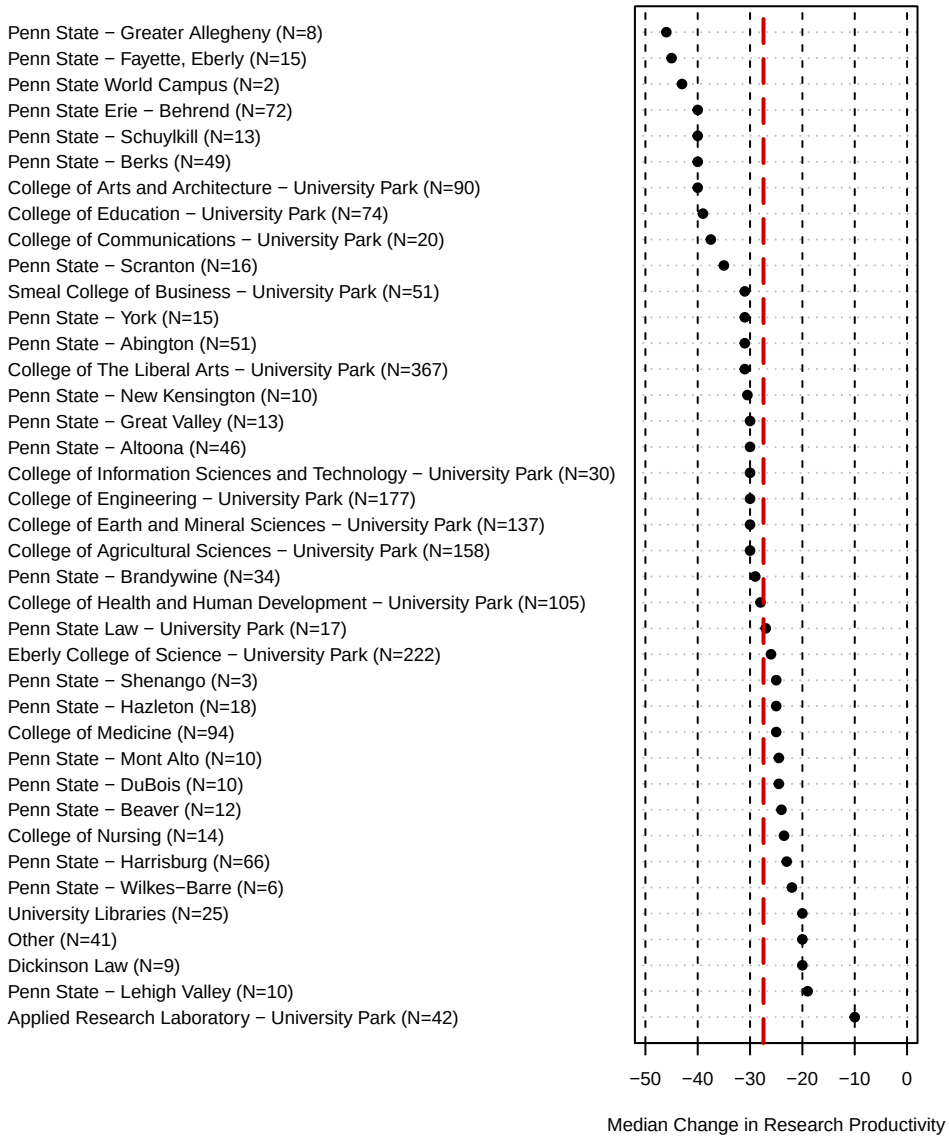

Figure 24: Median Change in Research Productivity by Campus/Unit