



## Article

# Disparities in COVID-19 Impacts on Work Hours and Career Satisfaction by Gender and Race among Scientists in the US: An Online Survey Study

Seulkee Heo <sup>1,\*</sup>, Pedro Diaz Peralta <sup>1,2</sup>, Lan Jin <sup>3</sup>, Claudia Ribeiro Pereira Nunes <sup>1,4</sup> and Michelle L. Bell <sup>1</sup><sup>1</sup> School of the Environment, Yale University, New Haven, CT 06511, USA<sup>2</sup> Administrative Law Department, School of Law, Universidad Complutense de Madrid, 28005 Madrid, Spain<sup>3</sup> School of Public Health, Yale University, New Haven, CT 06510, USA<sup>4</sup> Graduate Program in Law, School of Law, Federal University of Amazon, Manaus 69020-160, Amazonas, Brazil

\* Correspondence: seulkee.heo@yale.edu

**Abstract:** The impact of the COVID-19 pandemic on work–life balance may be unequal between female and male scientists. Further information is needed regarding whether the working conditions and career satisfaction for women and racialized scientists are disproportionately affected by the pandemic. This online survey collected data from 1171 scientists in science, technology, engineering, mathematics (STEM), and medicine (STEMM), public health, or other areas of science/engineering working in the US to examine potential disparities in changes in work hours and career satisfaction by gender and race/ethnicity. A significantly higher percentage of women reported increased work hours compared to men. Women, especially racialized women, experienced disproportionately higher increases in teaching and service than the other groups, which contributed to the increased total work hours for women. Satisfaction with the current career progress was lowest for racialized women compared to their counterparts. Our results indicate that the pandemic has inequitably affected allocation of workloads and career satisfaction by gender and race in scientific fields. Institutions of higher education and other research organizations should acknowledge the gender/race differences in science before and during the pandemic to better support the career development and achievement of all scientists, especially women and even more so racialized women.

**Keywords:** academia; COVID-19; gender; women career; race



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## 1. Introduction

Sex and gender differences in career development and promotion have been recognized in science and other academic fields for many decades (Collins et al. 2021; King and Frederickson 2021; Bailyn 2003). Universities and other institutions of higher education have long had gendered breakdowns of academics and faculty (Yildirim and Eslen-Ziya 2021). The importance of publications and citations for tenure assessment has benefited male academics who have higher publications and citations than women on average (Aksnes et al. 2011). Furthermore, research has demonstrated structured gender discrimination in grant funding success based on the male favoritism held by grant reviewers of scientific proposals, resulting in lower grant acquisition rates for women (Sato et al. 2021). Traditionally, gendered division of labor in society has contributed to these systematic gender differences in academia (Yildirim and Eslen-Ziya 2021). The “motherhood penalty” indicates lower salary and career development resulting from inequitable and disproportionate divisions of childcare responsibility for women (Malisch et al. 2020). Women with children are likely to allocate a smaller portion of their work hours to research, whereas the time allocation for men is less likely to be affected by parental status due to smaller responsibilities for childcare needs (Winslow 2010; Denson and Szelényi 2022). The higher

responsibility for childcare and domestic work for women, in addition to the gendered expectation in academia for women scientists, can also reduce the time for professional meetings, work-related travel, and networks for women (Cardel et al. 2020; Denson and Szelényi 2022), which can lead to exclusion of women from networks contributing to publishing success (Clancy 2020; Toutkoushian and Bellas 1999).

Recent studies have suggested that the COVID-19 pandemic worsened the existing gender differences for scientists in institutions of higher education by disproportionately affecting the work environment and working conditions between men and women (Górska et al. 2021; Brown et al. 2021; Yildirim and Eslen-Ziya 2021). The pandemic has caused unprecedented changes to scientific/academic work (e.g., closure of laboratories and research infrastructure, and transition to online teaching) (Pereira 2021), as well as the more general pandemic-related stressors such as childcare. Studies have demonstrated that higher-education institutions have adapted to the pandemic by implementing online courses, remote working, and new policies for physical access to campus, and extending tenure assessment for faculty (De Boer 2021; Jung et al. 2021; Yang and Huang 2021). Nonetheless, these policies did not always ensure equal support between men and women scientists. Studies found that “working from home” blurred the boundary between work and family, and exacerbated gendered divisions of duties within the household between men and women (Yildirim and Eslen-Ziya 2021). Caregiving activities diverted a substantial portion of the hours that women faculty with children could use for academic activities compared to male faculty or female faculty without children (Mason and Goulden 2004; Jacobs 2004).

Academics, especially women, responsible for children and other dependents were the most impacted group in terms of their capability to work under the pandemic and mitigation measures (Górska et al. 2021; Korbel and Stegle 2020; Nash and Churchill 2020). Although results are not perfectly consistent, many studies found relatively lower publication records for peer-reviewed journal articles and preprint archives for women compared to men since the beginning of the pandemic in various fields (Nash and Churchill 2020; Abramo et al. 2022; Bell and Fong 2021; Pereira 2021).

The term “intersectionality” refers to “the interaction between gender, race, and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcomes of these interactions in terms of power” (Davis 1981, 2008; Crenshaw 1989, 1991). The introduction of this term to the literature in 1989 was to initially note the need to consider both gender and race in shaping the multiple dimensions of Black women’s experiences in the United States (US) (Davis 2008; Harris and Patton 2019). Racialized women scientists experience both sexism and racism as intersecting systems of oppression and inequality (Samuel 2005; Ng 1994). Racialization refers to social construction or stratification that structures economic, political, social, and ideological levels by racial categories or races (Bonilla-Silva 1997). The term “racialized” here indicates all people that are non-Caucasian in race or non-White in color. Racialized faculty members, especially racialized women, experience intersectional discrimination in relation to teaching, funding, research, and tenure assessment as they are more rigorously evaluated than other faculty members by students and administrators (Samuel 2005; Croom 2017). The impacts of the COVID-19 mitigation measures (e.g., stay-at-home order) on scientific/academic productivity would be even greater for racialized academics and women who face intersecting systems of oppression based on race and ethnicity (Górska et al. 2021).

A few recent studies examined the intersection of gender and racial disparities during the COVID-19 pandemic in science. For example, a survey study found that the number of faculty members who were able to submit manuscripts as planned within deadlines during the pandemic was lowest for Black women (47.3%) and highest for White men (63.2%), compared to White women (50.1%) or Black men (63.2%) (Staniscuaski et al. 2021), indicating that racialized academics/faculty are more vulnerable to the impacts of the pandemic on work productivity. Despite the use of intersectionality as a concept

for understanding racial, ethnic, and gender disparities and inequality across various academic disciplines (Bailyn 2003), the body of literature on the intersecting racial and gender disparities in the impacts of COVID-19 on scientists is far smaller than that on gender disparities to date. Furthermore, the evidence of racial disparities of the COVID-19 impacts within the same gender category is comparatively scarce.

Practices in workload divisions and promotion assessments can aggravate gender and racial gaps in academia (Sutherland et al. 2022). Women faculty members generally have slightly more work hours per week than men faculty members, although results for the differences in hours for work between men and women faculty members vary across institutions and fields (Winslow 2010; Anders 2004). Studies of faculty members have frequently noted heavier loads for teaching and service, with adverse consequences for research productivity, grant applications, and tenure, for women and racial/ethnic minority faculty members (Baez 2000; Hirshfield and Joseph 2012; Toutkoushian and Bellas 1999; O'Meara et al. 2017). Guidance for racialized students is often more assigned to racialized faculty members, which results in higher workloads and time for mentoring and service and less time to focus on scholarship (Frazier 2011). Equitable and adequate allocation of various work forms among academics is also important for career satisfaction (Eagan and Garvey 2015). However, gender and racial differences in workload divisions may have been aggravated during the pandemic. During the COVID-19 pandemic, the demand for emotional and psychological support for students grew significantly (Górska et al. 2021), implying significant increases in time for service-related work in higher-education institutions. Under the current faculty assessment system in the United States (US), research and publishing tend to reward faculty members more greatly than teaching and service for many institutions (Toutkoushian and Bellas 1999). Hence, the increased workload for the service-related work during the pandemic may leave fewer hours for other forms of academic work (i.e., research and teaching) for female and racialized faculty members and may not be recognized as the most valued work output in performance or tenure assessment processes during and after the pandemic. However, to date, little is known about how time use and allocation for work by gender and race/ethnicity were affected specifically during the pandemic.

In October–December 2021, during the pandemic, we conducted an online survey in six languages about the impact of the pandemic on academic/scientific working conditions of male and female scientists in science, technology, engineering, mathematics (STEM) and medicine (STEMM), public health, or other areas of science/engineering. This study examined how the changes in the number of hours devoted to work and self-reported COVID-19 impacts on career differ by gender and race/ethnicity among scientists. Summaries of this survey are presented elsewhere with analysis of the responses related to mental health and wellbeing and thematic qualitative analysis (blind citation); in the current paper, we focus specifically on exploring differences in work hours and career satisfaction by race/ethnicity and gender for the subset of respondents who were from the US, which was the most represented country and the country with the most diversity in terms of race/ethnicity (blind citation).

## 2. Materials and Methods

### 2.1. Participants

We designed a survey questionnaire in six languages (English, Portuguese, Spanish, Mandarin Chinese, Korean, and Japanese) that asked questions related to the changes in the number of hours devoted to work and the degree of satisfaction for career progress. We targeted scientists who work in research at an educational institution (e.g., university/college), government agency, industry, and other institutions for science, technology, engineering, and mathematics (STEM), medicine, public health, or other areas of science/engineering. This article presents analysis based on survey respondents from the US to explore differences by race/ethnicity for this subset of the respondents.

Of the total participants ( $N = 1171$ ), 48.2% self-identified as male, 50.2% self-identified as female, and 1.6% self-identified as other (Table 1), compared to the US Census values of 53% male and 46% female. Participants self-identified as non-Hispanic White (74.6%), non-Hispanic Black (1.2%), Hispanic (4.0%), non-Hispanic Asian (15.0%), and non-Hispanic other single race (2.9%). Non-Hispanic multi-race was selected by 2.3% of the participants. These distributions are roughly similar to those of full-time faculty at US degree-granting postsecondary institutions at 75% White, 6% Black, 6% Hispanic, and 12% Asian (Hussar et al. 2020), although we had lower participation for Black and Hispanic scholars. The percentage of total US-born participants was 70.9%. The percentage of foreign participants was 78.9% for Asians, 14.3% for Blacks, 61.7% for Hispanics, 17.3% for Whites, and 32.2% for other race/ethnicity groups. Supplementary Figure S1 shows the distribution of study participants and US faculty by race/ethnicity and gender. By discipline, the largest group of participants was in medicine/public health/health science ( $N = 552$ , 47.1%). Of the total participants, 477 (40.8%) had children (age < 18 years) living at home. The percentages of participants living with children (age < 18 years) were similar between men ( $N = 226$ , 40.1%) and women ( $N = 246$ , 41.8%). About 79.8% ( $N = 935$ ) of participants were married or living with a partner. The percentage of marriage or living with a partner was higher in men ( $N = 472$ , 83.6%) than in women ( $N = 455$ , 77.4%).

**Table 1.** Characteristics of survey participants ( $N = 1171$ ).

	Total	Men	Women	Other
	$N$ (%)	$N$ (%)	$N$ (%)	$N$ (%)
Gender				
Men	565 (48.2)	-	-	-
Women	588 (50.2)	-	-	-
Other	18 (1.6)	-	-	-
Race/ethnicity <sup>b</sup>				
Single race				
White NH	872 (74.6)	419 (74.3)	444 (75.6)	9 (50.0)
Black NH	14 (1.2)	5 (0.9)	9 (1.5)	0 (0.0)
Hispanic	47 (4.0)	20 (3.5)	25 (4.3)	2 (11.1)
Asian NH	175 (15.0)	92 (16.3)	82 (14.0)	1 (5.6)
Other NH <sup>a</sup>	34 (2.9)	19 (3.4)	11 (1.9)	4 (22.2)
Multi-race NH	27 (2.3)	9 (1.6)	16 (2.7)	2 (11.1)
With children (age < 18 years) living at home				
Yes	477 (40.8)	226 (40.1)	246 (41.8)	5 (29.4)
No	692 (59.2)	338 (59.9)	342 (58.2)	12 (70.6)
Marital status				
Single (never married)	144 (12.3)	59 (10.4)	79 (13.5)	6 (33.3)
Married/living together with a partner	935 (79.8)	472 (83.6)	455 (77.4)	8 (44.4)
Divorced/separated/widowed	72 (6.1)	29 (5.1)	42 (7.1)	1 (5.6)
Unknown	20 (1.7)	5 (0.9)	12 (2.0)	3 (16.7)
Field <sup>b</sup>				
Agriculture	50 (3.1)	31 (3.7)	19 (2.5)	0 (0.0)
Astronomy	10 (0.6)	8 (0.9)	2 (0.3)	0 (0.0)
Biology	317 (19.4)	174 (20.6)	140 (18.3)	3 (11.1)
Chemistry	68 (4.2)	48 (5.7)	19 (2.5)	1 (3.7)
Computer	40 (2.4)	29 (3.4)	11 (1.4)	0 (0.0)
Engineering	90 (5.5)	64 (7.6)	25 (3.3)	1 (3.7)
Environmental science	100 (6.1)	63 (7.5)	33 (4.3)	4 (14.8)
Geology	18 (1.1)	10 (1.2)	7 (0.9)	1 (3.7)
Mathematics	62 (3.8)	37 (4.4)	24 (3.1)	1 (3.7)

**Table 1.** *Cont.*

	Total	Men	Women	Other
Medicine/public health	552 (33.7)	221 (26.2)	323 (42.2)	8 (29.6)
Multidisciplinary	101 (6.2)	48 (5.7)	49 (6.4)	4 (14.8)
Physics	52 (3.2)	40 (4.7)	12 (1.6)	0 (0.0)
Zoology	29 (1.8)	17 (2.0)	12 (1.6)	0 (0.0)
Other	148 (9.0)	55 (6.5)	89 (11.6)	4 (14.8)
Position				
Assistant professor	221 (18.9)	75 (13.3)	143 (24.3)	3 (16.7)
Associate professor	221 (18.0)	81 (14.3)	126 (21.4)	4 (22.2)
Professor	366 (31.3)	230 (40.7)	132 (22.4)	4 (22.2)
Postdoc	85 (7.3)	41 (7.3)	43 (7.3)	1 (5.6)
Researcher	186 (15.9)	91 (16.1)	92 (15.6)	3 (16.7)
Dean	20 (1.7)	11 (1.9)	9 (1.5)	0 (0.0)
Instructor	22 (1.9)	11 (1.9)	11 (1.9)	0 (0.0)
Other	58 (5.0)	25 (4.4)	32 (5.4)	1 (5.6)
Unknown	2 (0.2)	0 (0.0)	0 (0.0)	2 (11.1)

<sup>a</sup>: American Indian, Alaska native, native Hawaiian, Pacific Islander, or other indigenous races. NH = non-Hispanic. <sup>b</sup>: Multiple choices were allowed among the answers.

## 2.2. Procedure

Our survey was sent via email to scholars who published research articles registered at Scopus and PubMed during 2017–2021, and the survey collected responses from 5 October through 31 December 2021. This approach was based on published research using this method (Deryugina et al. 2021). The survey also recruited participants via advertisements on social media (Facebook and Instagram), which directed persons who clicked the link on social media to our questionnaire. The survey was anonymous (no collection of personal information). The first survey was an online informed consent form including the information for the research objectives, potential risks and benefits to participants, anonymity, research approval institution, and contact information of the researchers. The remainder of the survey questionnaire was only shown to the participants who agreed to this online informed consent form. Therefore, written informed consent was obtained from all participants. The survey was designed to take 10–15 min for the participants to complete on average.

## 2.3. Material

As a first step, we designed an original survey questionnaire in English. Then, researchers whose English is excellent translated the English version survey into their native languages including five languages (Portuguese, Spanish, Mandarin Chinese, Korean, and Japanese). Study participants were provided with all language options and could choose the language they prefer.

The survey questionnaire asked a wide range of information including the field of study, country of residence, sex/gender, race/ethnicity, status as a parent of one or more children aged <18 years, type of institution, highest-educational degree, number of years since obtaining the highest degree, percentage of time devoted to different forms of academic labor (i.e., research, teaching, service/administration, and other academic labors) during pre-pandemic periods, academic position (postdoc, researcher, instructor, professor, and leadership roles), and tenure status (if applicable). Participants were asked to choose all categories that applied to their race/ethnicity for answers among “White”, “Black or African American”, “Hispanic or Latino”, “American Indian or Alaska Native”, “Asian”, “Native Hawaiian or Pacific Islander”, “other indigenous race/ethnicity”, and “other”. These categories were applied slightly modifying the categories of ethnicity and race by the US Office of Management and Budget (Egede 2006), which include two ethnic categories “Hispanic or Latino” and “Not Hispanic or Latino” and five racial categories: White, Black or African American, American Indian or Alaska native, Asian, and native Hawaiian or

other Pacific islander. In our survey questionnaire, we applied an additional category of “other indigenous race/ethnicity” as there may be more local and indigenous categories in some cultures. Nonetheless, the categories used in the survey are not exhaustive and do not reflect the diversity of race/ethnicity across various geographical regions and countries. Furthermore, notions and measures of race and ethnicity differ across cultures and countries. For example, widely used categories for race and ethnicity in a nationwide census in one country may not adequately represent the dynamics of race/ethnicity in other countries (Morning 2008). Therefore, for this paper, we focused on the participants who lived in the US. Our survey asked for country of residence, not more detailed information (e.g., which states). Race/ethnicity was categorized as “non-Hispanic White”, “non-Hispanic Black”, “Hispanic”, “non-Hispanic Asian”, “non-Hispanic other single race”, and “non-Hispanic multi-race”, as in previous studies (Yi et al. 2014).

We faced a challenge regarding the formation of the questions for “sex” or “gender” as the concepts of genders are not consistent across countries, cultures, or time (Clayton and Tannenbaum 2016; Morgenroth et al. 2021; Schiebinger and Stefanick 2016). Our survey was originally conducted to collect data from scientists in six languages across many countries, with responses from >130 countries, which created challenges with respect to our ability to fully assess gender versus sex given the different perceptions and understanding of these terms across cultures. The survey asked participants to identify their sex/gender as male, female, transgender, gender non-conforming, or other with the opportunity to write in text for “other”. While “sex” or “gender” are not interchangeable terms, the original survey was designed to be easily interpretable across various cultures and countries, including the many that currently do not have separate terms for “sex” and “gender”. Thus, our study, including respondents from over 130 countries, had limitations for defining sex and gender (blind citation). This limitation remained in the dataset used in the current study focusing on responses from scientists at US organizations/institutions. We recognize this as a limitation and note that gender and sex are separate concepts, that many other genders exist, and that non-male/female persons exist everywhere (Spizzirri et al. 2021; Reisner et al. 2016; Torggrimson and Minson 2005). In this study, we used three categories of self-reported sex/gender (“male/man”, “female/woman”, and “other”) as the previous literature for faculty and academics has widely focused on the comparison between binary sex categories of men and women, and because the number of respondents who identified as categories other than male or female was small (1.6%). Hereafter, we refer to this variable as “gender” although we recognize that some participants viewed this as sex and others as gender, and that these are not interchangeable.

As an outcome of interest, we constructed a question asking whether and how the pandemic changed work hours in two questions. The first question asked the approximate change in the number of work hours per week during the COVID-19 pandemic compared to the pre-pandemic period, with answers selected among five categories: “significantly decreased”, “slightly decreased”, “neither decreased nor increased”, “slightly increased”, and “significantly increased”. The second question asked the number of hours for that change, with seven categories of values between –25 and 25 h, separately for research, fundraising, teaching, and administration/service.

Then, the survey asked whether participants were worried about the detrimental impacts of COVID-19 on (1) the number of research papers and proposals, (2) teaching quality, and (3) promotion and career for the long-term, with answers selected among “agree” (i.e., agree this is a concern), “neither agree nor disagree”, and “disagree.” The question for the worry about the number of research papers and proposals was slightly modified from a previous survey study by Breuning et al. (Breuning et al. 2021). Moreover, we asked how much participants agreed with the statement “I am satisfied with my current career progress” with answers selected among “agree”, “neither agree nor disagree”, and “disagree.”

## 2.4. Data Analysis

Using the survey data, this research applied quantitative data analysis. Descriptive statistics of the study participants were examined for gender, race/ethnicity, living with children (age <18 years) at home, marital status, field (e.g., major), and job position. Descriptive statistics were also applied to the changes in work hours by gender and race/ethnicity. Correlation analyses, such as the Mann–Whitney–Wilcoxon test and the Kruskal–Wallis test, were used to assess how variables of gender and race/ethnicity were correlated with the outcome variables (i.e., changes in work hours and worries about productivity) among the study participants. The statistical analyses were performed using R software (version 3.3.0).

In statistical analysis, we used three outcome variables. The first variable was the changes in work hours measured with five ordinal categories. The second variable was the changes in work hours with seven categories of hours (e.g., –25 h or more, –24 to –8 h, –7 to –1 h, 0 h, 1 to 7 h, 8 to 24 h, and 25 h or more). The last variable was the degree of worry (i.e., agree, neither agree nor disagree, and disagree) for concerns related to research, teaching, and career development. The percentages of responses for categories of changes in work hours (i.e., significantly decreased, slightly decreased, no change, slightly increased, and significantly increased) by gender (female, male, other) and race/ethnicity were compared. We grouped gender by “other” for all categories other than male and female, given the small percentage of respondents in these categories (1.6%). The percentages of responses for seven categories of changed work hours were reported for total work and different types of work (research, fundraising, teaching, and administration/service). The percentages of responses for the degree of worry about COVID-19 impacting the number of research papers and proposals, teaching quality, and long-term career were compared by gender and race/ethnicity, as was the degree of satisfaction for current career progress by gender and race/ethnicity.

When considering race/ethnicity simultaneously with gender (e.g., Black male), the small number of participants in some groups hindered statistical tests such as the chi-squared test for the outcome variables including the changes in work hours. When we divided participants’ responses among the large number of categories of changes in work hours, the small number of participants in the groups hindered comparison in statistical analyses. Therefore, for the purpose of statistical tests, we used simplified racial/ethnic groups of “non-Hispanic White” and “racialized scientists” groups, while we report the descriptive statistics for the outcome variables for each racial/ethnic and gender group in the results. The Mann–Whitney–Wilcoxon test, which is widely used for comparing ordinal dependent variables, was used to compare the outcome distributions between these two racial/ethnic groups. The Mann–Whitney–Wilcoxon test was also applied to compare the two gender groups (e.g., female and male). The Kruskal–Wallis test was applied for comparing outcome variables simultaneously among the four groups of race/ethnicity and gender: “racialized women”, “non-Hispanic White women”, “racialized men”, and “non-Hispanic White men”. We recognize the diverse cultures and experiences within racialized populations; however, as our participants were mostly non-Hispanic White (74.6%), we had limited ability to fully disentangle the impacts among different race/ethnicities in all analyses.

## 3. Results

### 3.1. The Impact of the COVID-19 Pandemic on the Number of Work Hours

The impact of the COVID-19 pandemic on changes in the number of work hours was assessed. On average, 45.5% of participants responded that the number of work hours increased during the pandemic compared to the pre-pandemic period. Among men, 13.1% responded that the number of work hours “significantly increased”, and 25.0% responded “slightly increased” (Figure S2). A higher percentage of female participants than male participants experienced increased work hours (22.4% for “significantly increased” and 30.1% for “slightly increased”). The percentage of participants whose work hours decreased was roughly similar between men (23.8%) and women (23.1%). Due to the small number of

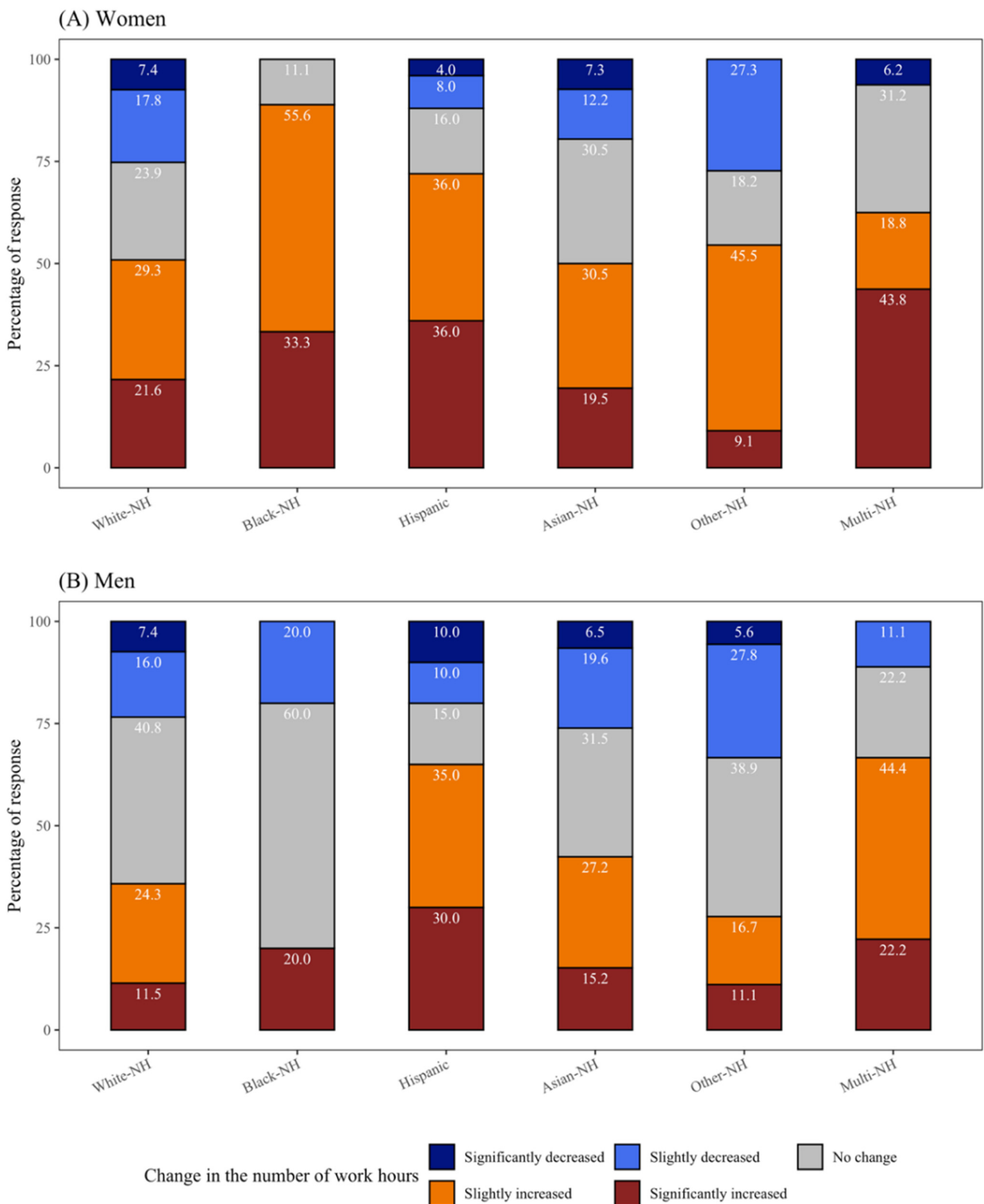
participants who self-identified gender as “other” (1.6%), the Mann–Whitney–Wilcoxon test was applied to only female and male groups. The Mann–Whitney–Wilcoxon test showed significantly different changes in the number of work hours between men and women ( $U = 187,370$ ;  $p$ -value  $< 0.001$ ), with women experiencing a higher burden of increased work hours compared to men.

The changes in work hours by race/ethnicity are shown in Figure S3. The racial/ethnic group with the largest fraction of participants with increased work hours was Hispanic persons (65.9%) followed by Black persons (64.3%). The “other” non-Hispanic single-race group had the smallest percentage of participants with increased working hours (39.4%) followed by non-Hispanic White persons (43.7%). A Mann–Whitney–Wilcoxon test on the ordinal variables of work hours between the two groups of non-Hispanic White and racialized scientists, as an alternative test, indicated a higher burden of increased work hours in racialized scientists ( $U = 139,470$ ;  $p$ -value = 0.032).

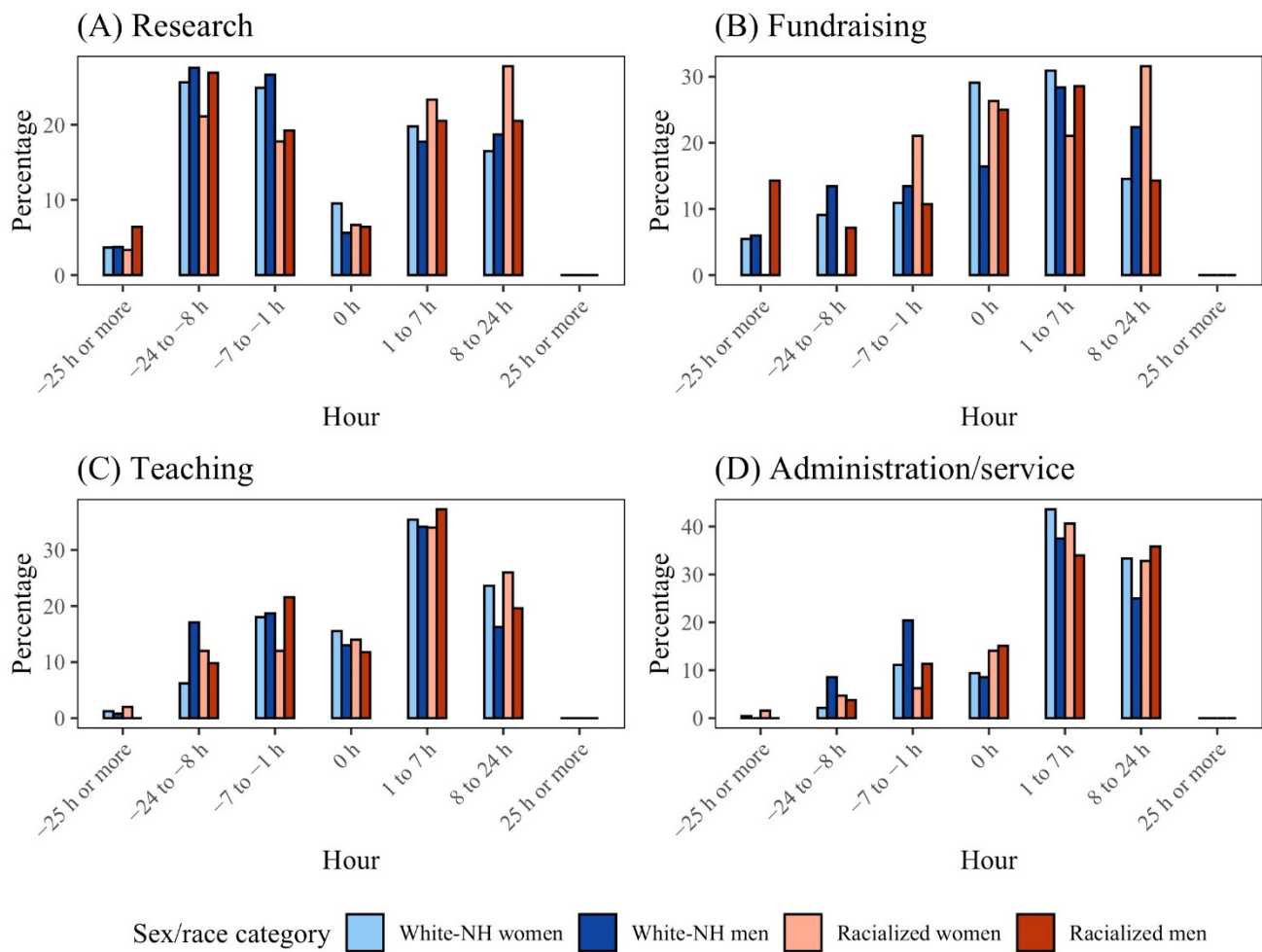
The changed work hours by race/ethnicity stratified by gender are shown in Figure 1. In all racial/ethnic groups, except for the non-Hispanic multi-race group, the percentage of persons whose working hours increased during the pandemic compared to the pre-pandemic period was higher for women than men. The difference was notable for Black participants; seven of nine (88.9%) Black women and one of five (20.0%) Black men experienced increased working hours during the pandemic, although we note a small sample size for Black participants ( $N = 14$ ). Among women, non-Hispanic Black persons and Hispanic persons had a higher percentage of persons with increased work hours than other race/ethnicity groups. For men, non-Hispanic multi-race and Hispanic participants had the highest percentage of participants with increased work hours. On the basis of the Kruskal–Wallis test, the burden of the increased number of work hours was highest in racialized women, followed by non-Hispanic White women, racialized men, and non-Hispanic White men (Kruskal–Wallis  $\chi^2 = 22.0$ ;  $p$ -value  $< 0.001$ ).

Of the total 1171 participants, 756 participants (64.6%) responded to the question regarding the changes in work hours by form of academic and scientific work, and the results are shown in Figure 2. For all categories (research, fundraising, teaching, and administrative/service), both men and women and all race/ethnicity subgroups included some persons who experienced increased work hours and some who experienced decreased work hours. In general, most people experienced more work hours for fundraising, teaching, and administrative/service tasks. The changes in work hours for research and fundraising were higher in racialized women compared to White women and men, although the difference was not statistically significant (Kruskal–Wallis  $\chi^2 = 5.6$  and  $p$ -value = 0.130 for research; Kruskal–Wallis  $\chi^2 = 2.2$  and  $p$ -value = 0.531 for fundraising). There were no significant differences in the changes in work hours for teaching among the gender and racial groups (Kruskal–Wallis  $\chi^2 = 5.4$ ;  $p$ -value = 0.144). Of racialized women who responded to the question regarding teaching ( $N = 50$ ), 60.0% of participants ( $N = 30$ ) had increased work hours ( $\geq 1$  h/week) for teaching, whereas the percentage of participants with increased work hours for teaching was 59.0% ( $N = 95$ ), 50.0% ( $N = 29$ ), and 56.9% ( $N = 62$ ) for White women, White men, and racialized men, respectively. The percentage of participants with 8–24 increased work hours per week for teaching was 23.6% ( $N = 38$ ) for White women and 26.0% ( $N = 13$ ) for racialized women. The time for administration/service-related work generally increased across all groups (average 71.0%,  $N = 359$ ), but the increased work hours were significantly lower for White men (Kruskal–Wallis  $\chi^2 = 10.5$ ;  $p$ -value = 0.015); 62.5% ( $N = 95$ ) of White men experienced increased work hours ( $\geq 1$  h/week), whereas the percentage of participants with increased work hours was 76.9% ( $N = 180$ ), 73.4% ( $N = 47$ ), and 70.8% ( $N = 37$ ) for White women, racialized women, and racialized men, respectively.





**Figure 1.** Changes in the number of work hours during the pandemic compared to pre-pandemic periods by race, stratified by gender: (A) women; (B) men.

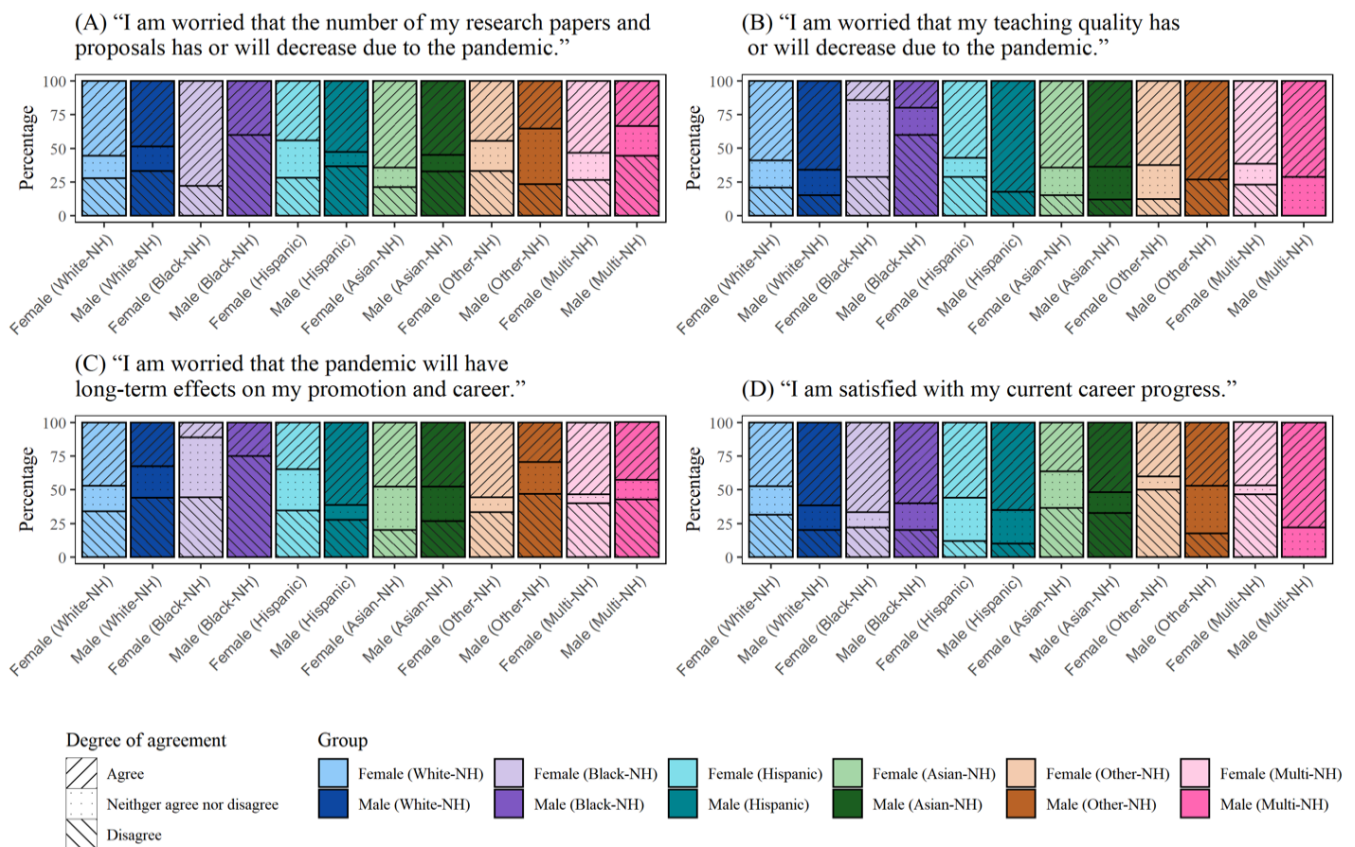


**Figure 2.** Changes in the work hours (per week) for different form of academic and scientific labor by gender and race/ethnicity: (A) research; (B) fundraising; (C) teaching; (D) administration/service. Note. NH = non-Hispanic.

### 3.2. The COVID-19 Pandemic Impacts on the Perception Regarding Career

Figure 3 shows participants’ perceptions regarding concerns for the impacts of the COVID-19 pandemic on their work and career among, by gender and race/ethnicity groups ( $N = 1117$ ). Most participants were worried that their number of research papers and proposals had decreased or would decrease due to the pandemic, especially for non-Hispanic Black women (77.8%,  $N = 7$ ) followed by non-Hispanic Asian women (64.5%,  $N = 49$ ). Non-Hispanic White men had lower worry about the pandemic’s impacts on research papers and proposals (48.4%,  $N = 196$ ) compared to White women (55.4%,  $N = 229$ ), as well as compared to racialized men or racialized women (50.0% [ $N = 66$ ] and 59.0% [ $N = 79$ ], respectively) (Kruskal–Wallis  $\chi^2 = 7.7$ ;  $p$ -value = 0.053). Most groups were worried that their teaching quality had decreased or would decrease due to the pandemic, except for Black women or Black men. The most concerned group was Hispanic men (82.4%,  $N = 14$ ). Overall, men had more concern for the pandemic’s impacts on teaching than women for non-Hispanic White scientists (65.9% [ $N = 230$ ] for men and 59.1% [ $N = 204$ ] for women) and for racialized persons (66.4% [ $N = 73$ ] for men, 59.3% [ $N = 64$ ] for women), but the results were not statistically different among these four racial and gender groups (Kruskal–Wallis  $\chi^2 = 5.2$ ;  $p$ -value = 0.157). The percentage of scholars worried about the pandemic’s impact on long-term career and promotion was highest in Hispanic men (61.1%,  $N = 11$ ) and lowest for Black women (11.1%,  $N = 1$ ). In comparing scholars who are White and racialized persons, non-Hispanic White men were the least worried about the impacts of the pandemic on long-term career and promotion (32.6%,  $N = 119$ ) compared to 47.0%

( $N = 186$ ) for non-Hispanic White women, 46.1% ( $N = 59$ ) for racialized men, and 44.0% ( $N = 55$ ) for racialized women (Kruskal–Wallis  $\chi^2 = 19.3$ ;  $p$ -value  $< 0.001$ ). Satisfaction with current career progress was highest for non-Hispanic multi-race men (77.8%,  $N = 7$ ) and lowest for non-Hispanic Asian women (36.5%,  $N = 27$ ). Non-Hispanic White men were significantly more satisfied with their career progress (61.5%,  $N = 248$ ) than non-Hispanic White women (47.3%,  $N = 201$ ), racialized men (55.1%,  $N = 75$ ), or racialized women (43.6%,  $N = 58$ ) (Kruskal–Wallis  $\chi^2 = 24.3$ ;  $p$ -value  $< 0.001$ ).



**Figure 3.** Degree of agreement on the impacts of the COVID-19 pandemic on work and career progress, by gender and race/ethnicity. Note. NH = non-Hispanic.

#### 4. Discussion

There has been a growing interest in the disparities for the negative impacts of the COVID-19 pandemic on sciences and higher-education institutions by gender (Toutkoushian and Bellas 1999). To our knowledge, there is minimal research examining how the impacts of the COVID-19 pandemic on the productivity of scientists differ by intersections of gender and race/ethnicity. The intersectionality as a theoretical framework theory is important to recognize the intersect of gender with race/ethnicity dimensions (Davis 1981, 2008; Crenshaw 1989), and it became one of the major theoretical contributions in the social movements of people at the intersections of multiple forms of oppression such as Black and other racialized women (Ferreira and Santos 2022; Thomas 2022). We hypothesized that the personal experiences regarding scientific productivity would not be homogeneous within the same sex or racial/ethnic group. Applying the intersectionality theory in this research provided a better understanding of how race/ethnicity interplays with gender to produce different experiences, particularly in relation to the changes in work conditions (e.g., hours) and perception of productivity among scientists. We discuss the gender disparities first and then the intersections of gender and race/ethnicity regarding the impacts of the COVID-19 pandemic below.

Results from earlier studies are inconsistent regarding how working hours in higher-education institutions differ by gender (Toutkoushian and Bellas 1999). We found that the impacts of the COVID-19 pandemic and mitigation measures on working conditions in the US were not gender-neutral; the number of participants with increased work hours during the pandemic was significantly higher in female participants than male participants. This could be due to the higher proportion of women participants than men participants in the medical and public health fields, where the workload has greatly increased due to COVID-19. Another reason could be that the academic service including mentoring and emotional support for students has generally been disproportionately performed by female academics than male academics (Hirshfield and Joseph 2012; Toutkoushian and Bellas 1999), as shown in our data. Our study had relatively higher rates of junior and mid-level academics (e.g., associate professor, assistant professor) for women than men, which may be a potential reason for higher increased work hours.

In our study, the changes in work hours for research, teaching, and fundraising were not statistically different among different racial and gender groups. Administration and service-related work increased more for both racialized women and racialized men. Our results for teaching workloads by sex/gender and race/ethnicity during the pandemic are inconsistent with the findings for allocation of teaching by gender in previous studies, such as the 1993 national survey of postsecondary faculty (NSOPF) that demonstrated significantly higher time in teaching and lower time for research for women compared to men (Toutkoushian and Bellas 1999). Yet, in the NSOPF study, it was not clear if women had been assigned heavier teaching loads or women had spent more time in course preparation than men (Toutkoushian and Bellas 1999), warranting future studies on this topic.

On the other hand, our results found that race/ethnicity intersected with gender regarding the changes in time for work during the pandemic compared to the pre-pandemic periods. Recent studies also suggested that race and gender unequally allocate service to faculty and eventually imbalance career development of women, especially racialized women academics (Domingo et al. 2022; Monroe et al. 2008). Studies found that the amount of total service, such as student service and recruitment, campus-related community activities, and administrative duties, is more performed by women faculty compared to male counterparts (Monroe et al. 2008; Hanasono et al. 2019; Wood et al. 2016). The increased service burden is likely higher in women and especially racialized women in STEM fields, where racialized women are underrepresented compared to other disciplines (Domingo et al. 2022). Studies conducted prior to the pandemic suggested that universities and higher-education institutions need to recognize that women tend to spend a larger amount of academic time on service activities than their male colleagues, and that such institutions should make service more visible and evaluated in promotion and tenure (Hanasono et al. 2019). Our survey data did not differentiate subcategories of service and administrative works, so we cannot identify which aspects of these tasks present the greatest burdens. Distinguishing administrative work related to the COVID-19 pandemic is also important for identifying potential gender and racial disparities in work burdens, which warrants further study.

Academics who spend more time in teaching and service-related activities may have fewer research products while teaching, research, administration, and service tend to become conflicting loads and compete for allocation of academics' time during the pandemic (Toutkoushian and Bellas 1999). Time allocation between research, teaching, and service is influenced by the institutional reward structures, which would play a role in the disproportionate time allocation for teaching and service for women and racialized faculty (Winslow 2010; O'Meara et al. 2018). The results of our study showing higher increases in work hours for women than men have important implications given the previous literature suggesting that women have struggled with lower submission rate or number of publications of scientific articles (Nash and Churchill 2020; Abramo et al. 2022; Bell and Fong 2021; Pereira 2021). This may indicate that there are obstacles hindering the successful transformation of academic labors of women into academic outcomes, such as publications or grant

successes, which are central to the reward structures of current performance assessment systems. Some studies demonstrated that altered childcare demands as a consequence of the COVID-19 pandemic for women compromised their ability to submit articles (Walters et al. 2022; Staniscuaski et al. 2021), indicating the need for institutional policies on gender equality and work–life balance in science and higher-education institutions. For example, institutional policies can provide support for relief of service or teaching duties to allow time for grant writing or to undertake training in grant writing (Sato et al. 2021).

Our study found that White male scientists were more likely to be satisfied with their career development than other groups, which is consistent with other work. Studies in the 1990s found that male academics were generally more satisfied than female academics in overall job security and job situations in Western countries and some Asian regions such as Hong Kong (Poole et al. 1997). Some recent studies have shown that women faculty were more likely to be dissatisfied for overall workload (Jacobs 2004) and institutional support for family and children (Deutsch and Yao 2014). Another previous study found that Black and Latino faculty members were less likely to be satisfied with working for their institutions and departments compared to Asian or White faculty members (Denson et al. 2018). A previous quantitative study found that stress due to racial discrimination at institutions (e.g., unequal expectations and beliefs that racialized faculty must work harder than their colleagues) among racialized faculty members compared to their White colleagues was significantly correlated with reduced research productivity (Eagan and Garvey 2015). Monitoring time allocation for different type of academic and scientific labor is important as different forms of work (i.e., teaching, research) may have different associations with satisfaction for workloads among faculty members. For example, previous studies found that faculty with larger allocation of work hours for research than for other labors had a lower likelihood of dissatisfaction for their overall workloads (Jacobs and Winslow 2004; Bentley et al. 2013), which could be related to predominant preference for research by doctorate degree holders in academia (Escardíbul and Afcha 2017). Academics with more time available for research also tended to stay and pursue careers at their institutions (Lawrence et al. 2014). For scientists who have spent more time teaching or providing service during the COVID-19 pandemic, the relatively decreased research time may cause concerns about future career development and promotion. Racialized scientists tend to go through a more rigorous verification process than others in promotion and tenure assessment (Social Sciences Feminist Network Research Interest Group 2017), and such racial bias in the system along with the inequitable time allocation for work during the COVID-19 pandemic could adversely affect career development of racialized populations. Therefore, we suggest that it is important to consider the contribution of individuals to these various academic labors including service and administrations in the promotion assessment process during and after the pandemic.

Gender inequalities can be produced by legitimization through masculinized institutionalized policies explicitly and implicitly advantaging men over women (Hanasono et al. 2019; Acker 1990). Academic institutions with historical masculinity of performance assessment have generally assumed that White men with little duties for childcare and domestic work are the most ideal workers (Bleijenbergh et al. 2013; Bailyn 2003; Winslow 2010). Racialized faculty and non-US-born academics who are also women have encountered the lack of understanding and support from their male-dominant departments in STEM fields (Skachkova 2007). The effects of challenging situations for work due to the pandemic and mitigation measures for scientists are likely to persist (Górska et al. 2021), further widening the gender and racial differences in success in academic careers. The disproportionate repercussion by the COVID-19 pandemic could put female scientists at a higher risk of losing progress for career development under “masculine academia” constructed around the life experiences of men where research success is prioritized for career progress by the organization (Nash and Churchill 2020; Ivancheva et al. 2019; Bailyn 2003). The disparities in the compromised productivity in science due to the pandemic may be also associated with race/ethnicity. The results presented here can inform institutional policies, such as

providing support for female and racialized academics, monitoring allocation of workloads within departments, and establishing work–life balance supports, to diminish differences by gender and race for the impacts of COVID-19 for scientific and other academic work.

This study can potentially aid scholars and administrators to establish policies reducing gender bias and racial/ethnic discrimination in the scientific community during and after the COVID-19 pandemic. This study provides evidence on the intersected vulnerability by gender and race/ethnicity to the impacts of the COVID-19 pandemic and mitigation measures for scientists. The previous literature for time allocation for academic labors largely focused on racism in higher education, with less frequent focus on the ways in which experiences within these groups vary by gender (Griffin and Reddick 2011). Given that conflicting duties at work and at home are commonly referred to as contributors to gender gaps in academia, and that there is insufficient research on the institutional inequalities widening gender disparities (Sutherland et al. 2022), our study provides important evidence and implications for the importance of acknowledging the gender gaps in academia and support systems for faculty members and scientists during and after pandemics, especially for women and even more so for racialized women.

However, we note several limitations of the current study. The percentage of Black participants (1.2%) in our study was lower than the percentage of Black faculty members (5.7%) in the US in 2018 reported by the National Center for Education Statistics (NCES 2019). Thus, our survey results may not be fully generalized for all Black faculty/academics. Furthermore, we combined race and ethnicity in our categories (e.g., non-Hispanic White, non-Hispanic Black, Hispanic, and Asian), given the small number of participants in some categories, as performed in earlier research (Yi et al. 2014; Egede 2006). Nonetheless, we note the limitation that only “Hispanic” ethnicity was considered, and Hispanic ethnicity includes many different ethnic groups and subgroups across 20 different countries (Egede 2006). Moreover, we note that our results for the dissatisfaction with research and time allocation for research in our study may not be applicable to certain academic positions, especially instructors or lecturers. Although we used a published method for recruitment, a small number of potential participants did not wish to be contacted through their email based on their scientific literature; thus, we do not recommend this methodology. The distribution of our survey to scientists who have published scientific articles in 2017–2021 may have excluded some scientists and scholars who have been less active in sciences or those with positions less associated with research activities (e.g., instructors) from our study population. Additionally, our survey did not collect information on household composition, occupational status of partner, household income, or other factors that may be associated with the changes in work hours and work satisfaction of the survey participants.

Lastly, as discussed in Section 1, our study faced limitations of how “sex” and “gender” were considered, given that the original survey included six languages, with responses from over 130 countries including many cultures that do not currently distinguish between these concepts. We acknowledge that the distinction between sexual orientation and gender is critically important and that there are multiple gender categories (Torgrimson and Minson 2005; Spizzirri et al. 2021; Reisner et al. 2016; Peters and Norton 2018). Nonetheless, the words “sex” and “gender” are often used interchangeably in cultures and countries where there are currently no separate words for sex and gender. Addressing these concepts is challenging across six languages and the cultures of >130 countries where these concepts vary considerably compared to the usage in the Western cultures (Morgenroth et al. 2021; Schiebinger and Stefanick 2016; Clayton and Tannenbaum 2016; Peters and Norton 2018; Abbey et al. 2004; Riley 1997). We assume that the term “sex” used in this analysis likely represented biological sex for some participants and gender for others. The impacts of COVID-19 on academic fields may differ between sex and genders; therefore, future studies need more detailed subgroups for sex and gender, with language specific to the culture. Furthermore, this survey did not collect information on sexual orientation, which is a topic for future work.

## 5. Conclusions

Our survey study provides empirical evidence that gender and race/ethnicity were associated with work hours and worries for career and productivity among scientists in the STEM and medicine (STEMM) fields in the US during the COVID-19 pandemic. Our study found that the changes in work hours for research, teaching, administration, and service during the COVID-19 pandemic compared to the pre-pandemic periods differed by gender and race/ethnicity among scientists; women, especially racialized women, experienced disproportionately higher increases in work hours for teaching, administrations, and service. In addition, satisfaction with career progress was lower in women and in racialized scientists. The results in this study have implications for the establishment of actions to avoid worsening the gender and race/ethnicity differences in academia and scientific institutions during and after the COVID-19 pandemic.

**Supplementary Materials:** The following supporting information can be downloaded at <https://www.mdpi.com/article/10.3390/socsci11120577/s1>: Figure S1. Distribution by race/ethnicity and gender for (A) US faculty members at degree-granting postsecondary institutions (Hussar et al. 2020) and (B) study participants; Figure S2. Changes in the number of work hours during the pandemic compared to pre-pandemic periods by gender; Figure S3. Changes in the number of work hours during the pandemic compared to pre-pandemic periods by race and ethnicity.

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**Institutional Review Board Statement:** This research was deemed exempt by the Yale University Human Subjects Committee (protocol code 2000031343 and date of approval 28 September 2021). Ethical review and approval were waived for this study because the online survey this study used was anonymous.

**Informed Consent Statement:** The online consent form informed the participants of the purpose of the research, potential risks, and benefits to participants. Informed consent was obtained from all subjects involved in the study. Verbal consent forms were not obtained from the participants as this survey was anonymous (no collection for personal information), there were no direct contacts between the participants and authors, and the survey was conducted entirely online.

**Data Availability Statement:** The data are not publicly available as the data contain potentially sensitive health information, and the study participants did not consent to share any data publicly. The authors do not have the Institutional Review Board's approval to share the collected data publicly.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

- Abbey, Antonia, Christopher Saenz, Michele Parkhill, and Lenwood W. Hayman Jr. 2004. Gender. In *Encyclopedia of Women's Health*. Boston: Springer, pp. 517–19.
- Abramo, Giovanni, Ciriaco Andrea D'Angelo, and Ida Mele. 2022. Impact of COVID-19 on Research Output by Gender across Countries. *Scientometrics* 127: 6811–26. [[CrossRef](#)] [[PubMed](#)]
- Acker, Joan. 1990. A Theory of Gendered Organizations. *Gender & Society* 4: 139–58. [[CrossRef](#)]
- Aksnes, Dag W., Kristoffer Rorstad, Fredrik Piro, and Gunnar Sivertsen. 2011. Are Female Researchers Less Cited? A Large-scale Study of Norwegian Scientists. *Journal of the American Society for Information Science and Technology* 62: 628–36. [[CrossRef](#)]
- Anders, Sari M. van. 2004. Why the Academic Pipeline Leaks: Fewer Men than Women Perceive Barriers to Becoming Professors. *Sex Roles* 51: 511–21. [[CrossRef](#)]
- Baez, Benjamin. 2000. Race-Related Service and Faculty of Color: Conceptualizing Critical Agency in Academe. *Higher Education* 39: 363–91. [[CrossRef](#)]

- Bailyn, Lotte. 2003. Academic Careers and Gender Equity: Lessons Learned from MIT. *Gender, Work & Organization* 10: 137–53. [\[CrossRef\]](#)
- Bell, Michelle L., and Kelvin C. Fong. 2021. Gender Differences in First and Corresponding Authorship in Public Health Research Submissions during the COVID-19 Pandemic. *American Journal of Public Health* 111: 159–63. [\[CrossRef\]](#)
- Bentley, Peter James, Hamish Coates, Ian R. Dobson, Leo Goedegebuure, and V. Lynn Meek. 2013. Academic Job Satisfaction from an International Comparative Perspective: Factors Associated with Satisfaction across 12 Countries. In *Job Satisfaction around the Academic World*. Dordrecht: Springer, pp. 239–62.
- Bleijenbergh, Inge L., Marloes L. van Engen, and Claartje J. Vinkenburgh. 2013. Othering Women: Fluid Images of the Ideal Academic. *Equality, Diversity and Inclusion: An International Journal* 32: 22–35. [\[CrossRef\]](#)
- Bonilla-Silva, Eduardo. 1997. Rethinking Racism: Toward a Structural Interpretation. *American Sociological Review* 62: 465. [\[CrossRef\]](#)
- Breuning, Marijke, Christina Fattore, Jennifer Ramos, and Jamie Scalera. 2021. The Great Equalizer? Gender, Parenting, and Scholarly Productivity during the Global Pandemic. *APSC* 54: 427–31. [\[CrossRef\]](#)
- Brown, Cristal, Tessa K. Novick, and Elizabeth A. Jacobs. 2021. Gender Disparities in Authorship of Invited Manuscripts during the COVID-19 Pandemic. *Women's Health Reports* 2: 149–53. [\[CrossRef\]](#) [\[PubMed\]](#)
- Cardel, Michelle I., Emily Dhurandhar, Ceren Yazar-Fisher, Monica Foster, Bertha Hidalgo, Leslie A. McClure, Sherry Pagoto, Nathaniel Brown, Dori Pekmezi, and Noha Sharafeldin. 2020. Turning Chutes into Ladders for Women Faculty: A Review and Roadmap for Equity in Academia. *Journal of Women's Health* 29: 721–33. [\[CrossRef\]](#) [\[PubMed\]](#)
- Clancy, Annette. 2020. On Mothering and Being Mothered: A Personal Reflection on Women's Productivity during COVID-19. *Gender, Work & Organization* 27: 857–59. [\[CrossRef\]](#)
- Clayton, Janine Austin, and Cara Tannenbaum. 2016. Reporting Sex, Gender, or Both in Clinical Research? *JAMA* 316: 1863–64. [\[CrossRef\]](#)
- Collins, Caitlyn, Liana C. Landivar, Leah Ruppanner, and William J. Scarborough. 2021. COVID-19 and the Gender Gap in Work Hours. *Gender, Work & Organization* 28: 101–12. [\[CrossRef\]](#)
- Crenshaw, Kimberlé. 1989. Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. *University of Chicago Legal Forum* 1989: 8.
- Crenshaw, Kimberlé. 1991. Mapping the Margins: Intersectionality, Identity Politics, and Violence against Women of Color. *Stanford Law Review* 43: 1241–99. [\[CrossRef\]](#)
- Croom, Natasha N. 2017. Promotion Beyond Tenure: Unpacking Racism and Sexism in the Experiences of Black Womyn Professors. *The Review of Higher Education* 40: 557–83. [\[CrossRef\]](#)
- Davis, Angela. 1981. *Women, Race, and Class*. New York: Vintage. ISBN 0-394-71351-6.
- Davis, Kathy. 2008. Intersectionality as Buzzword: A Sociology of Science Perspective on What Makes a Feminist Theory Successful. *Feminist Theory* 9: 67–85. [\[CrossRef\]](#)
- De Boer, Harry. 2021. COVID-19 in Dutch Higher Education. *Studies in Higher Education* 46: 96–106. [\[CrossRef\]](#)
- Denson, Nida, and Katalin Szelényi. 2022. Faculty Perceptions of Work-Life Balance: The Role of Marital/Relationship and Family Status. *Higher Education* 83: 261–78. [\[CrossRef\]](#)
- Denson, Nida, Katalin Szelényi, and Kate Bresonis. 2018. Correlates of Work-Life Balance for Faculty across Racial/Ethnic Groups. *Research in Higher Education* 59: 226–47. [\[CrossRef\]](#)
- Deryugina, Tatyana, Olga Shurchkov, and Jenna Stearns. 2021. COVID-19 Disruptions Disproportionately Affect Female Academics. *AEA Papers and Proceedings* 111: 164–68. [\[CrossRef\]](#)
- Deutsch, Francine M., and Beier Yao. 2014. Gender Differences in Faculty Attrition in the USA. *Community, Work & Family* 17: 392–408. [\[CrossRef\]](#)
- Domingo, Carmen R., Nancy Counts Gerber, Diane Harris, Laura Mamo, Sally G. Pasion, R. David Rebanal, and Sue V. Rosser. 2022. More Service or More Advancement: Institutional Barriers to Academic Success for Women and Women of Color Faculty at a Large Public Comprehensive Minority-Serving State University. *Journal of Diversity in Higher Education* 15: 365–79. [\[CrossRef\]](#)
- Eagan, M. Kevin, and Jason C. Garvey. 2015. Stressing Out: Connecting Race, Gender, and Stress with Faculty Productivity. *The Journal of Higher Education* 86: 923–54. [\[CrossRef\]](#)
- Egede, Leonard E. 2006. Race, Ethnicity, Culture, and Disparities in Health Care. *Journal of General Internal Medicine* 21: 667–69. [\[CrossRef\]](#)
- Escardíbul, Josep-O., and Sergio Afcha. 2017. Determinants of the Job Satisfaction of PhD Holders: An Analysis by Gender, Employment Sector, and Type of Satisfaction in Spain. *Higher Education* 74: 855–75. [\[CrossRef\]](#)
- Ferreira, Raquel Alexandra, and Maria Helena Santos. 2022. Gender and Ethnicity: The Role of Successful Women in Promoting Equality and Social Change. *Social Sciences* 11: 299. [\[CrossRef\]](#)
- Frazier, Kimberly N. 2011. Academic Bullying: A Barrier to Tenure and Promotion for African-American Faculty. *Florida Journal of Educational Administration & Policy* 5: 1–13.
- Górska, Anna Maria, Karolina Kulicka, Zuzanna Staniszevska, and Dorota Dobija. 2021. Deepening Inequalities: What Did COVID-19 Reveal about the Gendered Nature of Academic Work? *Gender, Work & Organization* 28: 1546–61. [\[CrossRef\]](#)
- Griffin, Kimberly A., and Richard J. Reddick. 2011. Surveillance and Sacrifice: Gender Differences in the Mentoring Patterns of Black Professors at Predominantly White Research Universities. *American Educational Research Journal* 48: 1032–57. [\[CrossRef\]](#)



- Hanasono, Lisa K., Ellen M. Broido, Marmaret M. Yacobucci, Karen V. Root, Susanna Peña, and Deborah A. O'Neil. 2019. Secret Service: Revealing Gender Biases in the Visibility and Value of Faculty Service. *Journal of Diversity in Higher Education* 12: 85–98. [CrossRef]
- Harris, Jessica C., and Lori D. Patton. 2019. Un/Doing Intersectionality through Higher Education Research. *The Journal of Higher Education* 90: 347–72. [CrossRef]
- Hirshfield, Laura E., and Tiffany D. Joseph. 2012. 'We Need a Woman, We Need a Black Woman': Gender, Race, and Identity Taxation in the Academy. *Gender and Education* 24: 213–27. [CrossRef]
- Hussar, Bill, Jijun Zhang, Sarah Hein, Ke Wang, Ashley Roberts, Jiashan Cui, Mary Smith, Farrah Bullock Mann, Amy Barmer, and Rita Dilig. 2020. *The Condition of Education 2020 (NCES 2020-144)*; Washington, DC: National Center for Education Statistics, U.S. Department of Education. Available online: <https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2020144> (accessed on 25 April 2022).
- Ivancheva, Mariya, Kathleen Lynch, and Kathryn Keating. 2019. Precarity, Gender and Care in the Neoliberal Academy. *Gender, Work & Organization* 26: 448–62. [CrossRef]
- Jacobs, Jerry A. 2004. Presidential Address: The Faculty Time Divide. *Sociological Forum* 19: 3–27. [CrossRef]
- Jacobs, Jerry A., and Sarah E. Winslow. 2004. Overworked Faculty: Job Stresses and Family Demands. *The ANNALS of the American Academy of Political and Social Science* 596: 104–29. [CrossRef]
- Jung, Jisun, Hugo Horta, and Gerard A. Postiglione. 2021. Living in Uncertainty: The COVID-19 Pandemic and Higher Education in Hong Kong. *Studies in Higher Education* 46: 107–20. [CrossRef]
- King, Molly M., and Megan E. Frederickson. 2021. The Pandemic Penalty: The Gendered Effects of COVID-19 on Scientific Productivity. *Socius* 7: 1–24. [CrossRef]
- Korbel, Jan O., and Oliver Stegle. 2020. Effects of the COVID-19 Pandemic on Life Scientists. *Genome Biology* 21: 113. [CrossRef] [PubMed]
- Lawrence, Janet H., Sergio Celis, Hee Sun Kim, Srah Ketchen Lipson, and Ximeng Tong. 2014. To Stay or Not to Stay: Retention of Asian International Faculty in STEM Fields. *Higher Education* 67: 511–31. [CrossRef]
- Malisch, Jessica L., Breanna N. Harris, Shanen M. Sherrer, Kristy A. Lewis, Stephanie L. Shepherd, Pumtiwitt C. McCarthy, Jessica L. Spott, Elizabeth P. Karam, Naima Moustaid-Moussa, Jessica McCrory Calarco, and et al. 2020. Opinion: In the Wake of COVID-19, Academia Needs New Solutions to Ensure Gender Equity. *Proceedings of the National Academy of Sciences of the United States of America* 117: 15378–81. [CrossRef] [PubMed]
- Mason, Mary Ann, and Marc Goulden. 2004. Marriage and Baby Blues: Redefining Gender Equity in the Academy. *The Annals of the American Academy of Political and Social Science* 596: 86–103. [CrossRef]
- Monroe, Kristen, Saba Ozyurt, Ted Wrigley, and Amy Alexander. 2008. Gender Equality in Academia: Bad News from the Trenches, and Some Possible Solutions. *Perspectives on Politics* 6: 215–33. [CrossRef]
- Morgenroth, Thekla, M. Gustafsson Sendén, Anna Lindqvist, Emma A. Renström, Michelle K. Ryan, and Thomas A. Morton. 2021. Defending the Sex/Gender Binary: The Role of Gender Identification and Need for Closure. *Social Psychological and Personality Science* 12: 731–40. [CrossRef]
- Morning, Ann. 2008. Ethnic Classification in Global Perspective: A Cross-National Survey of the 2000 Census Round. *Population Research and Policy Review* 27: 239–72. [CrossRef]
- Nash, Meredith, and Brendan Churchill. 2020. Caring during COVID-19: A Gendered Analysis of Australian University Responses to Managing Remote Working and Caring Responsibilities. *Gender, Work & Organization* 27: 833–46. [CrossRef]
- NCES. 2019. Full-Time Faculty in Degree-Granting Postsecondary Institutions, by Race/Ethnicity, Sex, and Academic Rank: Fall 2015, Fall 2017, and Fall 2018. Available online: [https://nces.ed.gov/programs/digest/d19/tables/dt19\\_315.20.asp](https://nces.ed.gov/programs/digest/d19/tables/dt19_315.20.asp) (accessed on 12 April 2022).
- Ng, Roxanna. 1994. Sexism and Racism in the University: Analyzing a Personal Experience. *Canadian Woman Studies* 14: 41–46.
- O'Meara, KerryAnn, Alexandra Kuvaeva, Gudrun Nyunt, Chelsea Waugaman, and Rose Jackson. 2017. Asked More Often: Gender Differences in Faculty Workload in Research Universities and the Work Interactions That Shape Them. *American Educational Research Journal* 54: 1154–86. [CrossRef]
- O'Meara, KerryAnn, Audrey Jaeger, Joya Misra, Courtney Lennartz, and Alexandra Kuvaeva. 2018. Undoing Disparities in Faculty Workloads: A Randomized Trial Experiment. *PLoS ONE* 13: e0207316. [CrossRef] [PubMed]
- Pereira, Maria do Mar. 2021. Researching Gender Inequalities in Academic Labor during the COVID-19 Pandemic: Avoiding Common Problems and Asking Different Questions. *Gender Work Organ* 28: 498–509. [CrossRef] [PubMed]
- Peters, Sanne A., and Rbyn Norton. 2018. Sex and Gender Reporting in Global Health: New Editorial Policies. *BMJ Global Health* 3: e001038. [CrossRef] [PubMed]
- Poole, Millicent, Laurel Bornholt, and Fiona Summers. 1997. An International Study of the Gendered Nature of Academic Work: Some Cross-Cultural Explorations. *Higher Education* 34: 373–96. [CrossRef]
- Reisner, Sari L., Tonia Poteat, JoAnne Keatley, Mauro Cabral, Tampose Mothopeng, Emilia Dunham, Claire E. Holland, Ryan Max, and Stefan D. Baral. 2016. Global Health Burden and Needs of Transgender Populations: A Review. *The Lancet* 388: 412–36. [CrossRef] [PubMed]
- Riley, Nancy E. 1997. Gender, Power, and Population Change. *Population Bulletin* 52: 2–48.
- Samuel, Edith. 2005. "Unsettling Relations": Racism and Sexism Experienced by Faculty of Color in a Predominantly White Canadian University. *The Journal of Negro Education* 74: 76–87.

- Sato, Sayaka, Pascal Mark Gyax, Julian Randall, and Marianne Schmid Mast. 2021. The Leaky Pipeline in Research Grant Peer Review and Funding Decisions: Challenges and Future Directions. *Higher Education* 82: 145–62. [\[CrossRef\]](#)
- Schiebinger, Londa, and Marcia L. Stefanick. 2016. Gender Matters in Biological Research and Medical Practice. *Journal of the American College of Cardiology* 67: 136–38. [\[CrossRef\]](#)
- Skachkova, Penka. 2007. Academic Careers of Immigrant Women Professors in the US. *Higher Education* 53: 697–738. [\[CrossRef\]](#)
- Social Sciences Feminist Network Research Interest Group. 2017. The Burden of Invisible Work in Academia: Social Inequalities and Time Use in Five University Departments. *Humboldt Journal of Social Relations* 39: 228–45.
- Spizzirri, Giancarlo, Rai Eufrásio, Maria Cristina Pereira Lima, Hélio Rubens de Carvalho Nunes, Baudewijntje P. C. Kreukels, Thomas D. Steensma, and Carmita Helena Najjar Abdo. 2021. Proportion of People Identified as Transgender and Non-Binary Gender in Brazil. *Scientific Reports* 11: 2240. [\[CrossRef\]](#)
- Staniscuaski, Fernanda, Livia Kmetzsch, Rossana C. Soletti, Fernanda Reichert, Eugenia Zandonà, Zelia M. Ludwig, Eliade F. Lima, Adriana Neumann, Ida V. Schwartz, and Pamela B. Mello-Carpes. 2021. Gender, Race and Parenthood Impact Academic Productivity during the COVID-19 Pandemic: From Survey to Action. *Frontiers in Psychology* 12: 663252. [\[CrossRef\]](#) [\[PubMed\]](#)
- Sutherland, Gerogina, Martha Vazquez Corona, Meghan Bohren, Tania King, Lila Moosad, Humaira Maheen, Anna Scovelle, and Cathy Vaughan. 2022. A Rapid Gender Impact Assessment of Australian University Responses to COVID-19. *Higher Education Research & Development* 41: 2079–93. [\[CrossRef\]](#)
- Thomas, Cate. 2022. Overcoming Identity Threat: Using Persona Pedagogy in Intersectionality and Inclusion Training. *Social Sciences* 11: 249. [\[CrossRef\]](#)
- Torggrimson, Britta N., and Christopher T. Minson. 2005. Sex and Gender: What Is the Difference? *Journal of Applied Physiology* 99: 785–87. [\[CrossRef\]](#) [\[PubMed\]](#)
- Toutkoushian, Robert Kevin, and Marcia L. Bellas. 1999. Faculty Time Allocations and Research Productivity: Gender, Race and Family Effects. *The Review of Higher Education* 22: 367–90. [\[CrossRef\]](#)
- Walters, Cyril, Graeme G. Mehl, Patrizio Piraino, Jonathan D. Jansen, and Samantha Kriger. 2022. The Impact of the Pandemic-Enforced Lockdown on the Scholarly Productivity of Women Academics in South Africa. *Research Policy* 51: 104403. [\[CrossRef\]](#)
- Winslow, Sarah. 2010. Gender Inequality and Time Allocations among Academic Faculty. *Gender & Society* 24: 769–93. [\[CrossRef\]](#)
- Wood, J. Luke, Adriel A. Hilton, and Carlos Nevarez. 2016. Faculty of Color and White Faculty: An Analysis of Service in Colleges of Education in the Arizona Public University System. *Journal of the Professoriate* 8: 85–109.
- Yang, Bin, and Cheng Huang. 2021. Turn Crisis into Opportunity in Response to COVID-19: Experience from a Chinese University and Future Prospects. *Studies in Higher Education* 46: 121–32. [\[CrossRef\]](#)
- Yi, Stella, Tali Elfassy, Leena Gupta, Christa Myers, and Bonnie Kerker. 2014. Nativity, Language Spoken at Home, Length of Time in the United States, and Race/Ethnicity: Associations with Self-Reported Hypertension. *American Journal of Hypertension* 27: 237–44. [\[CrossRef\]](#) [\[PubMed\]](#)
- Yildirim, T. Murat, and Hande Eslen-Ziya. 2021. The Differential Impact of COVID-19 on the Work Conditions of Women and Men Academics during the Lockdown. *Gender Work Organ* 28: 243–49. [\[CrossRef\]](#) [\[PubMed\]](#)