



# Impact of COVID-19 on Radiology Faculty - An Exacerbation of Gender Differences in Unpaid Home Duties and Professional Productivity

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**Rationale and Objectives:** The COVID-19 pandemic stresses the tenuous balance between domestic obligations and academic output for women across professions. Our investigation aims to evaluate the impact of the pandemic on the home duties and workplace productivity of academic radiologists with respect to gender.

**Materials and Methods:** A 49-question survey was distributed to 926 members of Association of University Radiologists in October 2020. Several categories were addressed: demographics; workplace changes; stress levels and personal experiences with illness; time spent on domestic obligations; and perception of productivity during COVID-19. Statistical analyses were performed using SAS version 9.4 software (SAS Institute, Cary, NC).

**Results:** A total of 96 responses across 30 states, 53.1% male and 46.9% female were received. Women report spending more time on unpaid domestic duties than men prior to COVID-19, with men spending a median of 5-10 h/wk and women spending a median of 10-15 h/wk ( $p = 0.043$ ). With pandemic onset, both genders reported that women did more of the homecare, when not split equally. Women with young children reported a significant decrease in work-from-home productivity compared to men with young children ( $p = 0.007$ ). Men reported they had more time to be productive compared to women ( $p = 0.012$ ).

**Conclusion:** The COVID-19 pandemic threatens to disrupt the advancement of women in radiology leadership roles by creating disparate effects on productivity due to increased workloads at home for women. This could potentially lead to decreases in promotions and research productivity in years to come that far outlast the acute phases of the pandemic.

**Keywords:** COVID-19; female; homecare; productivity; Gender Differences During COVID-19.

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## INTRODUCTION

Female faculty are underrepresented in positions of leadership across medical specialties (1). This is particularly true in radiology where women are underrepresented in the field overall. According to the Associations of American Medical Colleges (AAMC), in 2019, 50.5% of medical students but only 26.74% of radiology residents were female. This percentage has been unchanged since 2007 and increased only 2-3% over the last 20 years (2,3). Women represent only 34% of academic radiologists, 25% of vice chairs

and 9% of radiology chairs in the United States (4). Despite a trend of increasing female faculty in radiology academic centers between 2006 and 2017, the proportion of women radiology faculty decreases with increasing rank over that same period (5). Of note, despite the under-representation in academia, the disparity is even greater for women in radiology private practices (6). There are fewer published female first authors and fewer female senior authors in radiology (7,8). Women radiologists are also underrepresented on editorial boards for radiology journals, in national societies and are known to be paid less than their male counterparts at the highest levels of leadership (9-13). Additionally, NIH funding between 2016 and 2019 awarded more and larger grants to male radiologists than their female counterparts (14).

One of the largest contributing factors to this unbalanced representation in leadership is that many women face a “second shift” of unpaid “homecare” in addition to their professional workday which may include childcare, eldercare,

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housework, and food preparation (15–17). Unpaid domestic labor and care work has historically been unbalanced, with women performing the majority of the duties, even in highly educated couples (17). Many professionals balance these duties with the help of their community — childcare, schooling, housecleaners, nannies, babysitters, and the support of family members, particularly grandparents. COVID-19 has led to a disruption in the community involvement, leaving families to figure out a new solution. That solution has relied heavily on women, thus putting a further strain on professional productivity and potentially increasing burnout.

The purpose of our survey investigation was therefore to evaluate the impact of the COVID-19 pandemic on domestic obligations and academic productivity in academic radiologists with respect to gender.

## MATERIALS AND METHODS

### Survey and Respondents

Our study was approved for IRB exemption. A 49-item survey was generated in an iterative fashion by the Women's Leadership Initiative Metrics committee at our institution (see Appendix). A preliminary version was mailed to 5 radiologists with feedback incorporated for improved clarity and brevity. Between October 27 and November 24, 2020, an electronic link to the survey (Google Forms, Mountain View, CA) was sent twice to all active members of the Association of University Radiologists listserv, first as an initial request and then as a reminder. 922 non-trainee members received the first invitation and 926 the second request due to changes in membership in the listserv between surveys. The survey was anonymous and no identifiable data was documented. 96 physician responses were received out of 926 sent out (10.4% response rate).

The questions addressed the following categories: respondent demographics, including presence or absence of children in the home, workplace changes during COVID-19, personal experiences with COVID-19-related illness, stress levels, time spent on domestic obligations both pre and post the onset of the pandemic, working from home, and perception of levels of productivity during COVID-19. For the purposes of analysis, any reported children were divided into young children (elementary school age, defined as grade K-5, and younger) and older children (middle school age, defined as grades 6-8, and older). Productivity was defined as time spent on research, manuscript publication, committees, teaching, journal review and lecture creation.

Pre-pandemic and pandemic homecare obligations (including childcare, eldercare, food preparation, laundry etc.) were assessed by hrs/wk (1 = 0-5 hours/week, 6 = >25 hrs/wk). Relative time spent on homecare overall during the pandemic compared to pre-pandemic was recorded using a 1-5 Likert scale from 1 to 5 (1 = greatly decreased, 5 = greatly increased). A Likert scale was also used to assess ease of working from home versus working in-person at hospital/office

(1 = much easier, 5 = much harder). Productivity in terms of publications and research was also rated 1-5 (1 = greatly decreased, 5 = greatly increased), with the same scale applied to completed publications during the pandemic. Work-from-home productivity was rated 1-5 (1 = much less time be productive, 5 = much more time) which reflected general work productivity including clinical and academic work.

### Statistical Analysis

Descriptive analyses included mean (standard deviation SD), median, (inter quartile range IQR), and percent distribution of response options. A Fisher exact test was used to assess for statistical significance between sexes in terms of the split of homecare duties and to compare participants with and without children in terms of ease of work from home. An exact Mann-Whitney (MW) test was used to compare mean Likert scale responses to questions on productivity, housework and childcare; among participants with and without children. An exact paired-sample Wilcoxon signed rank was used to compare homecare work pre-COVID-19 to post-COVID-19 between males and females. The survey question asking participants to assess their own level of responsibility of homecare work generated only two respondents claiming responsibility of all of the work, too small for statistical analysis. This response was therefore combined with the next category, "I am responsible for most of the work." Statistical analyses were performed with SAS version 9.4 software (SAS Institute, Cary, NC). All statistical tests were conducted at a 2-sided 5% significance level.

## RESULTS

### Demographics

The demographic and professional characteristics of the respondents are summarized in Table 1. Briefly, there were 53.1% men and 46.9% women, with 90.6% (87/96) of all participants working full time and 9.4% (9/96) working part-time before the pandemic. 63.5% (61/96) reported living with children at home. Responses were received from radiologists in 30 states (Fig 1). The majority of participants were from academic centers 92.7% (89/96), in urban areas 74.7% (71/95). 91.7% (88/96) reported state or county-wide stay-at-home orders during the pandemic. For participants living with a spouse or partner, 87.5% (88/96) reported they were in an opposite-sex relationship, while 9.1% (8/96) reported they were in a same sex relationship. (Table 1).

### Workplace Changes During COVID-19

During the pandemic, 90.6% (87/96) of participants reported to their job in person, with the majority working some to the majority of hours at home (83.3%, 80/96). During this time, most (90.6%, 87/96) worked full time, while the rest worked part-time. 46.9% (45/96) of participants described income

**TABLE 1. Demographics of Respondents**

Demographic	n (%)
Age (y)	
20-30	None
31-40	18/95 (18.9)
41-50	30/95 (31.6)
51-60	24/95 (25.3)
61-70	20/95 (21.1)
70+	3/95 (3.2)
Radiology Specialty	
Abdominal	24/96 (25)
Neuroradiology	15/96 (15.6)
Administration	13/96 (13.5)
Breast Imaging	12/96 (12.5)
Thoracic	12/96 (12.5)
Musculoskeletal	11/96 (11.5)
Other specialties	28/96 (29.2)
Practice Setting	
Urban	71/95 (74.7)
Suburban	25/95 (26.3)
Rural	5/95 (5.3)
Race	
White	74/95 (77.9)
Asian	7/95 (7.4)
Black or African American	1/95 (1.1)
Hispanic or Latino	3/95 (3.2)
Prefer not to answer	10/95 (10.5)
Faculty with Children	
Only young children*	36/61 (59.0)
Both young and older children	14/61 (23.0)
Only older children**	25/61 (41.0)

\* Young children = Elementary school children and younger (infant, preschool/toddler, elementary school = grades K-5).

\*\* Older children = Middle school children and older (middle school age = grades 6-8; high school age = grades 9-12; and children >18 years old).

loss due to the pandemic, while 5.3% (5/95) were furloughed and one person lost his/her job.

### Personal Experiences With COVID-19-Related Illness

The majority of radiologists 89.6% (86/96) reported that neither they nor a member of their immediate household experienced COVID-19 symptoms. 5.2% (5/96) said a family member experienced severe illness requiring hospitalization or resulting in death. 17% (16/94) reported having family members who experienced mild-to-moderate illness, the latter two questions including family members outside the household.

### Stress Levels

69.2% (63/91) of the radiologist respondents reported increased stress levels. 62.5% (55/88) reported feeling overwhelmed, 61.4% (54/88) felt anxious, 60.2% (53/88) described irritability, while 55.7% (49/88) said they experienced difficulty sleeping.

Conversely, 5.5% (5/91) reported less stress with decreased feelings of burnout in 12.5% (11/88). In addition, 14.8% (13/88) radiologists said they felt relaxed, 17% (15/88) felt happy and 11.4% (10/88) felt fewer pressures. More women (51.2%, 22/43) than men (26.7% 12/45) reported feeling “out of control” ( $p < 0.028$ ) (Table 4).

### Domestic Obligations

Prior to COVID-19, women reported spending more time on homecare than men (any combination of childcare, elder-care, cooking/grocery shopping, and housework) with men spending a mean of 2.23 (median 2 = 5-10 hrs/week) and women spending mean of 2.83 (median 3 = 10-15 hrs/week),  $p = 0.043$ .

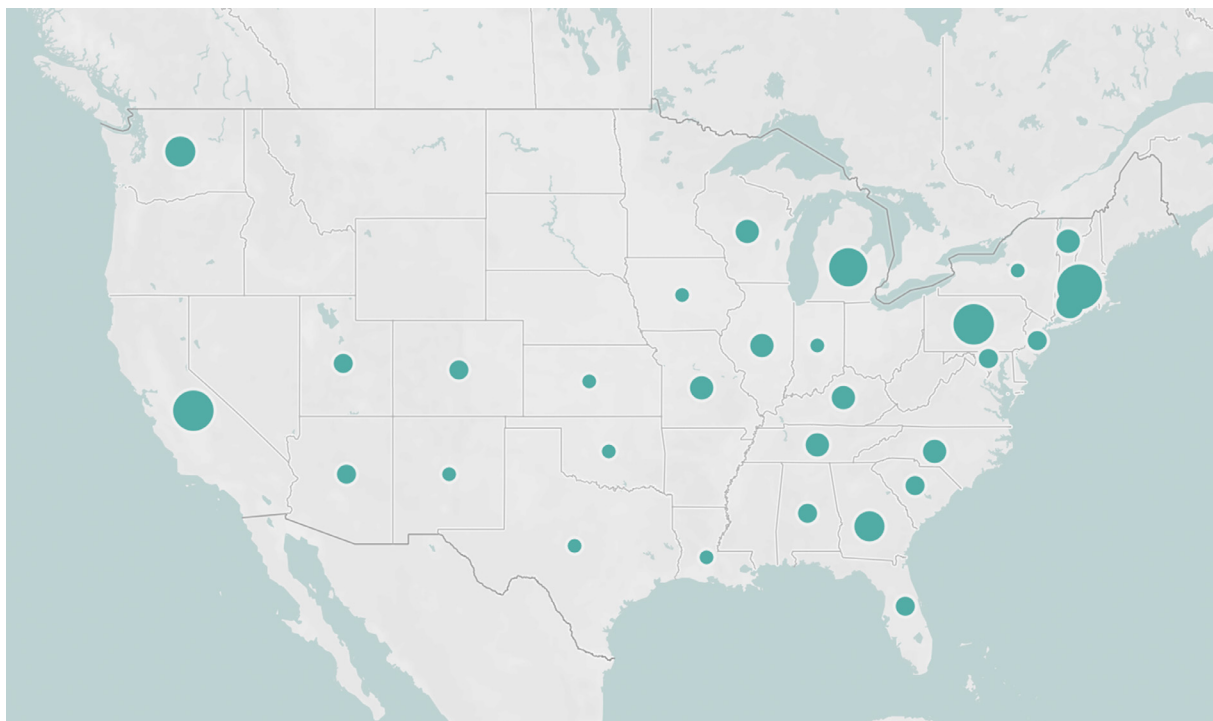
Both men and women reported statistically significant increases in time spent on homecare during the pandemic, (men mean Likert response of 2.23 +/- 0.93) to mean 2.75 +/- 1.33,  $p < 0.001$  and women mean 2.83 +/- 1.34) to mean 3.32 +/- 1.46,  $p = 0.040$ ). During COVID-19, 49% (18/37) of men reported sharing duties equally with their partner while only 35% (12/34) of women said they shared duties equally. When duties were not split equally, both men and women reported that women did more of the homecare. Of the men who reported an unequal distribution of homecare, 40% (15/37) reported that their partner did most/all of the homecare and only 11% (4/37) said they did most/all of the homecare themselves. Of the women who reported an unequal homecare distribution, 50% (17/34) said they did most/all homecare themselves and 15% (5/34) said their male partner did most/all of the homecare.

### Working From Home

52.7% (49/93) of all respondents reported it was harder to work from home while 40.9% (38/93) reported it was easier to work from home and 6.5% reported no change (6/93). 43% (9/21) of men without children and 46% (13/28) of men with children reported it was much or somewhat easier to work from home ( $p = 1.000$ ). For women, only 24% (7/29) of those with children felt it was easier to work from home while 60% of those without children reported it was easier working from home ( $p = 0.026$ ). The majority of respondents (67%, 63/94) favored continuing to work remotely at least some days with no difference found between men and women (68% males; 66% females).

### Work-From-Home Productivity

Women reported less time to be productive when working from home during COVID-19, (mean = 2.77 +/-1.27) when compared to working in-person at the hospital/office. Men reported more time to be productive with a mean of 3.42, +/-1.05 ( $p = 0.012$ ) (Table 2).



**Figure 1.** Map of the United States demonstrating survey respondents by state (30 states in total). Size of circle represents the total number of respondents per state (range 1-11 respondents). (Color version of figure is available online.)

**TABLE 2. Productivity**

Outcome	Men (n)	Men (mean)	Women (n)	Women (mean)	<i>p</i> value*
Hours spent on committees	15	3.07	21	2.90	0.770
Hours in meetings	15	4.07	21	3.29	0.129
Publications completed	15	3.00	21	2.57	0.226
Publications worked on	15	3.00	21	2.90	0.835
Virtual teaching	15	4.20	19	4.05	0.918
Work from home productivity	15	3.27	21	2.14	0.007

Mean is from a Likert scale of responses (1=much less time to 5=much more time).

\* *p* value based on Mann-Whitney test.

### Homecare and Faculty With Young Children

Men and women with young children did not significantly differ on measurements of perceived productivity, childcare or housework. However, the women with young children did report significant decrease in work-from-home productivity (mean 2.14) compared to men with young children (mean 3.27),  $p = 0.007$ . (Table 3).

There was no significant difference in productivity, childcare or housework reported by men with young children when compared to men without young children. In contrast, women with young children reported significant differences in multiple areas of productivity, housework and childcare when compared to women without young children.

When comparing productivity working from home between women with young children at home versus those without, women without young children reported no change (mean = 3.35  $\pm$  1.11) versus women with young children who

reported somewhat decreased productivity (mean = 2.14,  $\pm$  1.15) ( $p = 0.001$ ). Overall women with at least one child of any age reported somewhat increased housework ( $p = 0.026$ ) compared to those without children at home.

There was no significant difference between men and women without children and those with only older children in terms of change in amount of housework since the onset of COVID-19.

### DISCUSSION

This study aimed to evaluate the impact of the COVID-19 pandemic on male versus female academic radiologists with respect to both their professional productivity and homecare obligations. We found that even prior to the pandemic, women carried a disproportionate burden of homecare work compared to men, with women reporting significantly more hours per week

**TABLE 3. Effect of Young Children on Housework and Childcare**

Outcome	No Young Children		Young Children		p value
	n	mean	N	mean	
Homecare during pandemic					
Men	34	2.56	14	3.21	0.223
Women	23	2.83	18	3.94	0.028
Childcare during pandemic					
Men	15	3.53	15	3.87	0.264
Women	11	3.27	21	4.14	0.001
Amount of housework					
Men	34	3.44	15	3.73	0.263
Women	23	3.43	21	4.00	0.005

Mean is from a Likert scale of responses (amount of time spent on x has 1=greatly decreased, 2=somewhat decreased, 3=not changed, 4=somewhat increased, 5=greatly increased).

**TABLE 4. Stress During the Pandemic**

Type of Stress	Men (n=45)	Women (n=43)	p Value
Difficulty sleeping	55.6% (25)	55.8% (24)	1
Irritability	57.8% (26)	62.8% (27)	0.668
Feeling down	40.0% (18)	53.5% (23)	0.285
Feeling overwhelmed	44.4% (20)	58.1% (25)	0.21
Feeling anxious	55.6% (25)	67.4% (29)	0.28
Feeling out of control	26.7% (12)	51.2% (22)	0.028
Feeling upset	33.3% (15)	44.2% (19)	0.382
Feeling angry	53.3% (24)	44.2% (19)	0.404
Feeling happy	17.8% (8)	16.3% (7)	1
Feeling relaxed	17.8% (8)	11.6% (5)	0.551
Fewer pressures	8.9% (4)	14.0% (6)	0.517
Less burnout	8.9% (4)	16.3% (7)	0.347
Overall stress (mean)*	3.90	3.93	0.388

\* Both men and women reported somewhat increased to greatly increased levels of stress during the pandemic (Likert scale of 1-5, 1=greatly decreased, 5=greatly increased stress). According to a Mann-Whitney test, there was no significant difference between men and women in terms of the overall level of stress ( $p=0.388$ ).

on unpaid homecare duties compared to men. While men and women reported increased homecare duties during the pandemic, both men and women reported that women did more of the homecare when duties were not split equally between partners. The effect of children on increasing women's homecare duties was consistent across questions as well. Women with even one child (no matter the age of the child) reported significantly more (non-childcare specific) housework duties compared to women without children. In particular, women radiologists with young children reported more difficulty working from home, increased homecare burdens, and lower levels of professional productivity both compared to men with young children and compared to women with older children.

Women have been underrepresented in leadership roles in medicine in the United States and in academic radiology departments in particular (1,3,4). Some of this is attributed to a "second shift" after the end of the professional workday when women perform an unequal share of homecare duties.

Many working professionals maintain a precarious balancing act to meet the demands of both professional and domestic work. That balance relies heavily on structural supports such as schools, daycare, babysitters, grandparents and housekeepers (18). This arrangement was abruptly interrupted during the COVID-19 pandemic due to shelter-in-place orders that shuttered schools and daycare and dissuaded housekeepers, babysitters and grandparents from working in-person.

During shelter-in-place, the presence of more family members in the home participating in online school and work had the potential to create more housework. For example, COVID-19 introduced increased pressure to maintain sanitary conditions in the home (especially for medical essential workers potentially concerned about bringing home infection) (19). Grocery shopping may also have required more time and effort in the context of local food shortages and interrupted supply chains (20). Such unique considerations may have entailed more demanding domestic duties than during pre-COVID-19 times.

As described above, we found the most vulnerable group to be female faculty with young children at home. Recent studies have demonstrated women in the general (non-radiology) workforce cutting back on hours or leaving the workforce altogether in greater numbers than men due to the pandemic and its subsequent homecare burdens (21). We must be attuned to a potential similar impact in our own field. Multiple studies have established poor female representation in academic radiology leadership roles, in first and senior authorship on published papers, on editorial boards, in NIH funding and as invited speakers (7-9,12). Hardy et al report that Dr. Moms face structural discrimination, rigid work expectations and high debt with lower pay than their male counterparts (22). The impact of COVID-19 threatens to undermine small increases in female leadership roles, promotions and publications because women are expected to shoulder the unpaid, undervalued increase in homecare during this time. This can have long lasting implications for the future of female radiology faculty in journal submissions, leadership roles, and promotion.

It is important to recognize that early child-rearing years typically overlap with a crucial time in academic careers



when publications and committee work contribute to promotions and potential leadership roles. If this discrepancy in productivity yields more promotions of males and on a faster timeline in the upcoming years, then female faculty will be paying the price for their increased domestic work long after the pandemic has passed. The impact of COVID-19 has the potential to decrease female faculty advancement, thus exacerbating an already present gender disparity.

Limitations of this study include a relatively low response rate of 10.6%, although commensurate with other similar studies (23–25). Despite the low response rate, the demographics, stress levels, and decrease in income during the pandemic reflect those of recent studies of Covid impact on radiologists nationwide (26). Additional limitations include potential for selection bias as the survey was voluntary. Because the group of solicited respondents are all part of an academic radiology community, our findings may not reflect the perceptions of radiologists in private practice or hospital based, non-academic practices. Additional potential bias includes recall bias as the survey was performed in fall 2020 after stay-at-home orders had ended in many parts of the country. However, even as mandates changed, many faculty continued to work from home at the time of the survey. By that same token, this study represents a cross-section in time during the pandemic which may not reflect the continually evolving work adaptations made by institutions across the United States.

Despite these limitations, our survey exposes pandemic stressors on radiologists in general, and women radiologists with young children in particular. Future actions should include taking steps to mitigate the untenable work-life balance for both male and female faculty with young children including flexible work hours, continuing to support remote work options and, if possible, provision of childcare options. In addition, establishing and/or supporting the development of female leadership groups which offer structural support to faculty early in their careers can help promote more organic mentorship opportunities (27). Further studies should continue to evaluate leadership and promotion trends as well as attrition rates of female faculty from academic radiology.

## SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.acra.2021.05.004.

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