



# On the Frontline During the COVID-19 Pandemic: Gender Inequality and Experiences of Healthcare Workers in Pakistan

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This mixed methods study investigates the experiences of healthcare workers (HCWs) along gender lines during the COVID-19 pandemic in Lahore, the second most populous city in Pakistan. In-person semi-structured interviews ( $n = 62$ ) and researcher-administered surveys ( $n = 631$ ) were conducted with doctors and nurses in five private and public hospitals. The findings reveal that male and female HCWs shared experiences related to increased working hours, psychological burdens, and adverse financial impacts. However, female HCWs struggled more than male HCWs, as their responsibilities at home and in the workplace increased. Additionally, more female HCWs than their male peers reported experiencing occupational stress due to transportation issues, working during pregnancy, and discriminatory attitudes of the patients toward them. Building on the results from our study, we propose several technological and policy initiatives that can be adopted by governments and organizations, especially in countries like Pakistan, where women account for most of the healthcare workforce but continue to bear a heavier burden when balancing work and family.

CCS Concepts: • Social and professional topics → Government technology policy; Computing/technology policy; Socio-technical systems; Gender; Geographic characteristics; • Human-centered computing → Field studies; • Applied computing → Consumer health; Anthropology;

Additional Key Words and Phrases: Gender, healthcare workers, Covid-19

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## 1 INTRODUCTION AND BACKGROUND

Globally, females make up nearly 70% of the healthcare workforce; yet, they earn 28% less than their male colleagues and face systemic issues because of their gender [1]. Nearly two years of the COVID-19 pandemic took a toll on the entire world but more so on the **healthcare workers (HCWs)** fighting it on the frontline. Especially in Pakistan, where the healthcare system is frail and HCWs have limited workplace support, the implications of the pandemic were more pronounced. Pakistani women faced the brunt of these difficulties, in line with the global trends [2]. This article explores the experiences of HCWs during the COVID-19 pandemic in a patriarchal context, using a large city in Pakistan as an example, and highlights the responses of female HCWs whose experiences were shaped due to gender norms and stereotypes entrenched in the society's value system [3]. Based on the inferences drawn from the data collected in this work, we propose several technological and policy initiatives that can be used by the authorities to enact improvements for workers in the healthcare ecosystem.

### 1.1 Gender Disparity, Healthcare Sector, and COVID-19: Global Perspective

The perceived role of women as primary caregivers, inflexibility of organizations toward women's needs such as childcare facilities, and lack of accreditations and representation awarded to women at the top of the hierarchy contribute to factors that eventually "push" women out of their careers [4]. Furthermore, despite securing jobs in healthcare, women are still majorly dependent on their husbands to support their careers and allow them to work. This is a testament to the reality that practicing female HCWs face numerous hurdles in their careers and bear the brunt of domestic labor they are expected to provide as women by virtue of socially constructed gender norms. In contrast, male HCWs have more convenient access to training, and subsequently, they acquire a better skill set and are able to more confidently deploy coping strategies in times of conflicts and crises [5].

The inherent bias against female workers and their over-representation in the healthcare workforce exposed them to a higher risk of COVID-19 infection, alongside a range of physical, emotional, and psychological impacts [6]. They endured more burden compared to their male peers due to domestic responsibilities like caring for children and the elderly [7], and additional stressors, such as the fear of infecting their family and friends [8], limited freedom in terms of mobility [9], and gender-insensitive policies [10]. Consequently, within the HCW community, females were found to be more likely to suffer from post-traumatic stress symptoms [11, 12]. Moreover, females remained underrepresented in healthcare policy interventions and decision-making processes [13, 14]. To summarize, gender discrepancies continue to be reflected in healthcare systems [15], compromising their functioning and being exacerbated by the epidemic.

### 1.2 Pakistani Context

Pakistan ranks second worst in terms of gender parity out of 146 countries [16]. Socially-constructed, regressive gender norms and patriarchal value systems in the country translate into women not being afforded equal economic, social, and political opportunities [3, 17]. Women, therefore, experience a lack of autonomy in multiple spheres of their lives, such as their choice of partner, number of children, work, and education. According to Chaudhry and Rahman [18]: "male members of the family are given a better education and are equipped with skills to compete for resources in the public arena, while female members are imparted domestic skills to be good mothers and wives. They are given limited opportunities to create choices for themselves to change the realities of their lives". On top of this disparity, women in Pakistan are known to face domestic abuse, honor killings, and other forms of gender-based violence [19].

Gender inequalities in Pakistan also persist in the healthcare workforce and are rarely addressed by hospital administration. While the entire healthcare sector in Pakistan faced challenges during

COVID-19, females, which already suffer from gender disparity, faced major impact of the pandemic [20, 21]. Yet, women have played a central role in fighting the pandemic in Pakistan while working as doctors, nurses, and *lady health workers*.

Given the context of gender inequality in Pakistan and its manifestation in healthcare community, it is necessary to unpack how the COVID-19 pandemic may have affected female HCWs, who suffer from restrictive gender norms and gender inequalities [3, 18].

### 1.3 About This Work

This study draws on mixed methods research, comprising quantitative data from 631 survey responses and qualitative data from 62 interviews. It unpacks the experiences of HCWs in Lahore, Pakistan's second most populous city, where the impact of the pandemic was felt gravely due to a high population density, inadequate access to healthcare, misinformation proliferation, and mistrust in medical practitioners [22, 23]. Furthermore, it discusses the relevance of policy-based and HCI-based interventions and designs to improve female HCWs experiences, mitigate disparities, and advance equity.

The following research questions guide our study: (a) How did the HCWs experience the COVID-19 pandemic? and (b) How were their experiences divided along gender lines? We found that HCWs struggled due to financial impacts, workplace stressors such as lack of **personal protective equipment (PPEs)**, overexposure to COVID-19 patients, and long working hours in difficult conditions. Female HCWs, however, faced more specific issues such as aggressive patients, working during pregnancy, and the need to balance domestic responsibilities with their difficult jobs.

### 1.4 Policy and Technological Initiatives

In this article, we build inferences using quantitative survey data in conjunction with qualitative interviews to capture the experiences of the HCWs amid the COVID-19 pandemic. An understanding of these experiences is essential in devising policies and effective interventions that could focus on supporting HCWs and prompt hospital administrations and the government to consider their well-being. These interventions, detailed in Section 5.2, are guided by our findings and showcase how established HCI concepts can be adapted during situations of widespread medical emergency such as the COVID-19 pandemic. Some of the proposed interventions (such as algorithmic shift planning by hospitals and SMS/ringtone-based public service messages by the government) may turn out to be *low-hanging fruit* and can be deployed by the administrative authorities with little difficulty.

### 1.5 Goals and Contributions

Our study juxtaposes the survey answers with semi-structured interviews of the HCWs in a country where mixed methods studies, in particular from a gender lens, are rarely conducted. By highlighting the experiences and challenges of the HCWs, this holistic study aims to:

- (a) Produce more nuanced explanations and uncover the cultural aspects that underpin the experiences of HCWs in the Global South;
- (b) Bridge the gap between gender norms and HCWs' experiences research in Pakistan by revealing the context-specific challenges that male and female HCWs encountered during the pandemic;
- (c) Offer a detailed, in-depth analysis of the challenges faced by female HCWs before and during the pandemic so they can be better equipped to deal with waves of COVID-19 and future disease outbreaks; and

- (d) Propose data-driven technological and policy initiatives to direct researchers, policymakers and hospital leadership to coordinate to create more inclusive and equitable health systems.

## 2 LITERATURE REVIEW

Numerous studies on gender disparity exist, but the COVID-19 pandemic has prompted the need for a new line of research investigating the impact of the pandemic on existing gender inequalities [24]. Previous research has documented how the pandemic has negatively affected women's financial, social, and sexual autonomy. For instance, Ali et al. highlighted an increase in domestic violence against females [25], while Seck et al. reported a disproportionate burden of domestic responsibilities for women [26]. Another work studied the stark gender disparity in the reduction of work hours to fulfill childcare duties during the pandemic [27]. Sterling et al. discovered that home HCWs, comprised of majority women, suffered from a higher risk of contracting and transmitting COVID-19, as well as a lack of support and visibility [28]. Other studies have examined the gendered impact of the pandemic on the mental health of HCWs in developing countries, finding higher levels of depression, anxiety, and stress among women [21, 29, 30]. Expanding on this line of work, our study is the first to conduct a holistic investigation of the pandemic's impact on gender parity across multiple facets of HCWs' lives, such as work and career, family and relationships, mental health, and finance, and explore the interplay of these facets with one another.

Gender disparity has been a popular subject in HCI research as well, where the role of computing to mitigate such disparity is investigated. For instance, Dhaundiyal et al. conducted semi-structured interviews to gather insights into working women's daily workloads [31]; based on these insights, they created a visualization to accentuate female contribution in delivering care work, which is otherwise unrecognized, undervalued, and underappreciated. HCI researchers have also sought to investigate the issues women encounter as a result of non-inclusive design on job platforms [32] and on crowd work platforms [33]. Similarly, in the Indian subcontinent, where gender disparity and socio-cultural and patriarchal constraints are significant, HCI researchers have studied and addressed various aspects of women's experiences and challenges. For example, Sultana et al. [34] developed a tool called Unmochon to help women report and cope with online sexual harassment over Facebook Messenger while in another study [35], she examined the effects of societal, cultural, and economic obstacles on rural Bangladeshi women's usage of digital technology to motivate the development of new designs for low-income rural women. Similarly, Karusala et al. [36] explored how privacy, patriarchy, and participation shape women's experiences on social media platforms in India. In contrast, Tuli et al. [37] investigated the challenges and opportunities around designing menstrual health education interventions for adolescent girls in India. Our work, on the other hand, employs a mixed methods framework to gauge gender inequities in a very specific setting (at hospitals), with the aim to guide the design of customized, technological solutions to minimize gender inequities, particularly in difficult and emergency situations where HCWs are likely to be at the forefront.

A number of HCI researchers have also proposed tech-driven interventions to be deployed in healthcare settings, relying on information gathered from a variety of stakeholders, including patients, their families, doctors, and support staff, often in a mixed-methods approach. Haldar et al., for instance, conducted a mixed-methods study with pediatric patients and caregivers to assess the unique challenges associated with implementing a computerized peer support system for patients [38], while Khalid et al. carry out contextual inquiries with staff and patients to guide the design of a distress-reducing application [39]. On the other hand, Yang et al. utilize previously conducted user studies to propose a new form of a clinical decision support tool for more accurate prognostics [40], and Bhatt et al. carry out a participatory design study to create an interface that

will help HCWs better interpret patient condition [41]. It is worth emphasizing, however, that the majority of this research attempts to improve therapy, diagnosis, and clinical techniques, rather than the well-being of healthcare personnel. There does exist a small number of studies that focus on the well-being of healthcare professionals. For instance, Blair et al. used tweets [42] to assess the mental health of essential HCWs during Covid and Ismael et al. explored the online experiences of community health workers [43]. However, neither study is fully representative of HCW's experiences, which are shaped by the nuances of a physical hospital environment and, more recently, the unprecedented effects of the COVID-19 pandemic. The research by Ming et al. most closely resembles our own [44]. It follows a qualitative methodology and focuses on the invisible work done by female social health activists and home health aides. In contrast, our study adopts a mixed-methods approach and captures a holistic account of the domestic and professional experiences of male and female doctors and nurses during the pandemic. In conclusion, field research to explore and adequately inform the design of policies and technologies that could address the various social, psychological, and personal challenges faced by HCWs, as opposed to patients, remains scarce. Our work attempts to cover this gap.

### 3 METHODOLOGY

#### 3.1 Research Design

This study comprises surveys and semi-structured interviews that were conducted from mid-July to early September 2021 in private and public hospitals in Lahore, Pakistan. To strengthen the validity of our results and to attain a comprehensive understanding of participants' experiences, a concurrent triangulation design—an approach to mixed methods research that combines different research methodologies to balance out their inherent biases and limitations [45]—was deployed. Quantitative (closed-ended) and qualitative (open-ended) data were collected simultaneously but independently in a single phased-fashion from each hospital [46]. The convergence model [47] was used to corroborate and complement quantitative results with qualitative findings. The quantitative and qualitative elements were analyzed independently, and the results were interpreted together to provide well-validated findings and their explanations.

The survey instruments measured the different types of changes that female HCWs experienced in their professional and domestic lives due to the COVID-19 pandemic, whereas the qualitative data extensively evaluated their personal experiences, perceptions, and feelings. We hoped to achieve convergence by identifying and subsequently weaving similar themes and narratives together, and using joint displays to visualize newly found complementary insights.

Given the emergence of the Delta variant and the fourth wave of COVID-19 in Pakistan, the convergence variant of triangulation was well-suited for this study. It allowed us to conduct both quantitative and qualitative data collection at the same time, enabling us to limit our trips to the hospital.

#### 3.2 Sampling and Data Collection

We collected gender-disaggregated data to understand the distribution of risks and burdens among the HCWs along gender lines. Therefore, both male and female HCWs were included as participants in the study. Ensuing the pandemic's 4th wave was an imposition of lockdown policies and the state-driven mandatory vaccination drives. We collected 631 survey responses and conducted 62 interviews using convenience sampling in two private and three public hospitals (names have not been disclosed to ensure confidentiality). Biases in convenience sampling were minimized by ensuring that the HCWs belonged to a range of departments and were of varying ranks within the hospital.

### 3.3 Phase 1—Quantitative Study

Computer scientists and statisticians in our team hired and trained student volunteers, completing their undergraduate degrees at our university, to conduct the surveys. The student volunteers would carry copies of the printed survey to the field site, explain the research scope to interested respondents, obtain informed consent, and explain the questions and options in either Urdu or English (depending on the participant's language preference), and then ask the participant to choose the option that they support. The average time taken to complete the survey was 20 to 25 minutes. Table 1a depicts details regarding the background characteristics of the respondents.

**3.3.1 Survey.** The quantitative component of this study follows a descriptive, correlational model. The survey was divided into four sections, comprising multiple-choice questions, most of which were weighted either on a Likert or Rating scale. It was written in English and also translated into Urdu.

The first section of the survey inquired about the participants' sociodemographic details, which are summarized in Table 1a. The remaining sections focused on unique aspects of their experiences during the pandemic. The primary goal of the second section was to capture the impact of the participants' family dynamics, such as household type, number of dependents, and support from family on aspects such as mobility, safety, and care labor. The third section collected information about workplace dynamics. It aimed to evaluate whether or not the hospital administration policies provided adequate support to HCWs during the pandemic and how the pandemic affected their leisure time, mental peace, and work hours. Finally, the fourth section gauged the HCWs' understanding regarding the efficacy of vaccinations and the importance that they associated with getting vaccinated: a topic beyond the scope of this article.

**3.3.2 Statistical Analysis.** Quantitative data was analyzed through descriptive and inferential statistics. Since all quantitative responses are categorical or ordinal, they were encoded as numbers. Using Pearson's chi-square, Mann–Whitney  $U$ , and Wilcoxon signed rank tests and the resulting  $P$ -values, significance levels for the inferences were deduced. Answers to questions weighted over the Likert or rating scale were analyzed as a Likert-type item, such as the mode, and visualized using contingency tables, histograms, and pie-charts.

### 3.4 Phase 2—Qualitative Study

The semi-structured interviews were conducted by anthropologists in our core research team. They had the expertise to build rapport with the respondents and address sensitivities arising during extended conversations. The interview participants were approached in the hospital and asked to participate in an in-depth, semi-structured interview. Participants who displayed interest in being interviewed were told about the details of the study and ethical matters, such as informed consent, confidentiality, and anonymity. The participants' interviews were conducted in English and Urdu, depending on the language that they felt comfortable speaking. The duration of the interviews ranged from ten minutes to two hours.

**3.4.1 Interview Guide.** The interview participants were encouraged to discuss their opinions, beliefs, and experiences during the semi-structured interviews. An interview guide, divided into sections mainly comprising personal information, differences in their lives before and during the pandemic, physical, mental, and emotional impacts of COVID-19, patients' attitudes toward them, and COVID-19 risks and perceptions, was designed before the interviews so that the participants would not dissuade from the topic of discussion. Still, the guide was flexible enough to allow the respondents to express themselves freely and informally. All interviews were taken in-person, audio-recorded, and transcribed into English to maintain consistency. Data collection proceeded

Table 1. Demographic Characteristics of Respondents

(a) Quantitative study ( <i>n</i> = 631)			(b) Qualitative interviews ( <i>n</i> = 62)		
	<i>N</i>	%		<i>N</i>	%
Gender			Gender		
Male	205	32.5	Male	26	41.9
Female	424	67.2	Female	36	58.1
Prefer not to say	2	0.3			
Age			Age		
18–29	433	68.6	18–29	12	19.4
30–39	153	24.2	30–39	13	21
40–49	25	4	40–49	—	—
50–59	19	3	50–59	4	6.5
60–69	1	0.2	60–69	—	—
70 or older	0	0	70 or older	—	—
Prefer not to say	0	0	Prefer not to say	33	53.2
Role			Role		
Nurse	230	36.5	Nurse	17	27.4
Doctor	389	61.6	Doctor	42	67.7
Other	12	1.9	Other	3	4.9
Monthly Household Income			Monthly Household Income		
PKR 0–25,000	57	9	PKR 0–25,000	—	—
PKR 25,000–50,000	134	21.2	PKR 25,000–50,000	—	—
PKR 50,000–100,000	225	35.7	PKR 50,000–100,000	—	—
PKR 100,000–150,000	106	16.8	PKR 100,000–150,000	—	—
PKR 150,000+	109	17.3	PKR 150,000+	—	—
Marital Status			Marital Status		
Single	355	56.2	Single	19	30.6
Married	267	42.3	Married	26	41.9
Divorced	6	1	Divorced	—	—
Widowed/Widower	3	0.5	Widowed/Widower	—	—
Prefer not to say	0	0	Prefer not to say	17	27.4

until a saturation point was reached, whereby additional interviews did not shed light on new aspects for analysis.

**3.4.2 Thematic Analysis.** The interview transcriptions were imported into NVivo for analysis. From each interview, common themes were coded and subsequently named based on the discussed topic. There were 22 significant nodes in total and 839 references. To code data under a particular node, transcribed text was highlighted and pulled to the identified node. The top three nodes with the largest number of references are as follows: (1) Work-life balance—75 references; (2) Fears about COVID-19—68 references; (3) Increasing responsibilities—65. Worries about finances (61 references), PPE (59 references), and mobility (45 references) were also some of the common themes that emerged from the transcripts. Additionally, examples of the least discussed aspects in the interview include government assistance (14 references), misinformation (12 references), and religion (4 references), which were excluded from being further analyzed to see links between the HCWs' responses. The core themes that emerged from the data were then examined to form interpretations and explain quantitative results.

**3.4.3 Ethical Considerations.** This study was approved by the IRB at our university. Participants were well-informed of the study and their informed consent was taken before the surveys and interviews were conducted. Additionally, they were told about their right to withdraw from the study without providing any reasons or negative effects. The data that we collected was kept confidential and anonymous, and no one besides the core research team was allowed to access the data.

### 3.5 Sociodemographic Characteristics

Table 1a summarizes the sociodemographic characteristics of the survey respondents. Nearly 36.5% and 61.6% of the survey sample consisted of nurses and doctors, respectively, and more than 90% of all respondents were aged between 18–39. In Table 1b, the sociodemographic characteristics of the interview participants are shown to have a similar distribution, i.e., doctors (~67.7%) outnumber nurses (~27.4%). Even though 33 out of 62 participants did not mention their age, as they were on duty and we chose to ask them more urgent questions about their COVID-19 experiences, over 85% of those who specified their age were in the 18–39 age bracket.

Furthermore, ~67% of the survey respondents and ~58% of the interviewees identified themselves as female. More than 75% of both male and female survey respondents performed duty in the COVID-19 ward at least once, and all interview participants were involved in working with COVID-19-infected patients at some point during the four waves of COVID-19 in Pakistan. The survey and interview demographics revealed that gender, marital status, and the number of children did not play a role in determining who would perform duties in the COVID-19 wards.

**Comparative Groups:** Nurses in Pakistan are predominantly females and so were all the nurses in our study; we interviewed 17 nurses (see Table 1b) for the qualitative component while 230 nurses participated in the survey (Table 1a). Therefore, the *nurses versus doctors* comparison in all our findings only considered female doctors, which made up a little less than 50% of all the doctors. Gendered comparison within the group of doctors considered 205 males versus 194 females for the quantitative study and 26 males versus 19 females for the interviews.

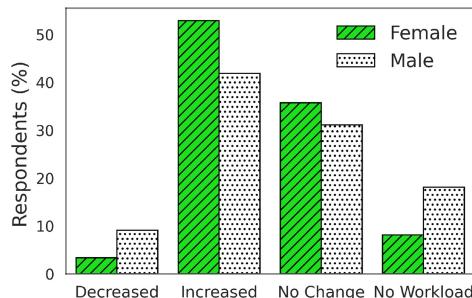
## 4 FINDINGS

The findings of this study are divided into three major themes: (1) challenges of increasing household responsibilities; (2) difficulties related to working in hospitals; and (3) psychological burden and distress in the face of uncertainty surrounding COVID-19. The themes discuss quantitative and qualitative findings that shed light on the experiences, feelings, and views of the HCWs.

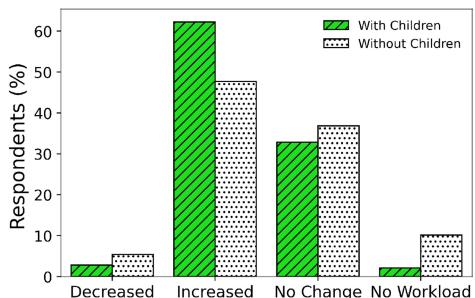
### 4.1 Household Responsibilities

The HCWs were on the frontline of the fight against COVID-19, and the challenges of working during the pandemic were exacerbated due to the adverse impacts of the crisis on their household responsibilities. When asked how the pandemic affected the burden of their *domestic work*, over half (approx. 55%) of the survey respondents who did household work claimed that their workload had increased, whereas it remained unchanged for about a third of the respondents; about 10.5% had no obligation to undertake household chores. A small percentage of respondents (about 5%) reported a decrease in their household workload. The reason for this decrease was uncovered during the interviews and was attributed to spouses being more available (owing to working from home) and, thus, sharing the household burden more proactively. Figure 1 depicts the changes in household burden for specific respondent groups: for doctors (1(a)) and for females (1(b)).

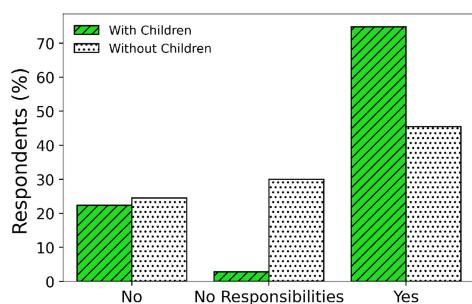
Over 66% of the survey respondents reported that it had become more difficult to maintain work-life balance due to the COVID-19 pandemic, while 33.9% did not believe it had a negative



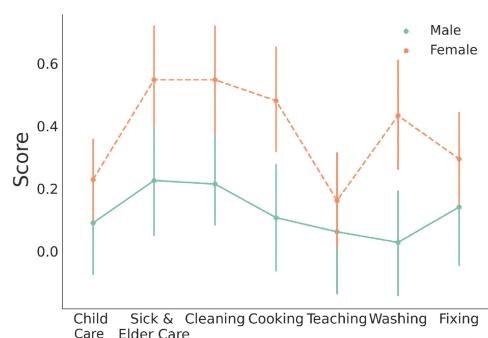
(a) Change in domestic workload after the pandemic started, as reported by all doctors



(b) Change in domestic workload after the pandemic started, as reported by the female HCWs



(c) Changes in work-life balance during the pandemic, as reported by the female HCWs (doctors and nurses)



(d) Changes in the household workload burden during the pandemic across categories of household tasks

Fig. 1. Impact of the pandemic on domestic workload/responsibilities, as indicated by the survey data.

impact on their work-life balance. These stats for female HCWs with children were even more pronounced. Data from the survey responses revealed that the share of household responsibilities shouldered by women was heavily dependent on whether they had children or not  $\chi^2(3,424) = 13.8, p = 0.003$ . Figure 1(b) shows 62.2% of female HCWs with children reported feeling more burdened with household work compared to 45.3% of the female HCWs without children. According to Figure 1(c), 74.8% of women with children found it extremely challenging to balance their domestic work with professional responsibilities in comparison to only 45.5% of women who did not have children suggesting that their experiences differed owing to the more challenging situations faced by HCWs who were mothers  $\chi^2(2,424) = 48.4, p < 0.001$ . The interview participants revealed that factors, such as closure of children's schools and laying off domestic workers to minimize their family members' exposure to COVID-19, led to a surge in their household responsibilities. For instance, a female doctor explained how household responsibilities had increased owing to her children receiving online education during the pandemic:

*Working ladies have to manage homes as well as their job, and in our case, it's the hospital. It has become difficult for female health workers to manage work at hospitals. If we have morning shifts, our children in grade 5 or higher can perhaps manage their online classes but younger children like preschoolers, or first to third graders, cannot attend and manage the online classes on their own. It was a problem for us so we had to request schools to start evening classes for children who have*

*working mothers, so they can assist them in taking their classes. However, they did not cooperate. (P.2)*

While some the HCWs' families offered them support and encouraged them to perform duties in the hospitals, other HCWs, especially female doctors and nurses, also had to face a lack of familial support as they were considered to expose their family members to the virus. A female doctor, in her early 20s, narrated the lack of support shown by her husband amid the pandemic:

*My husband made me leave work during the pandemic. I did not perform my hospital duties for four months. He did not even let me resign. (P.6)*

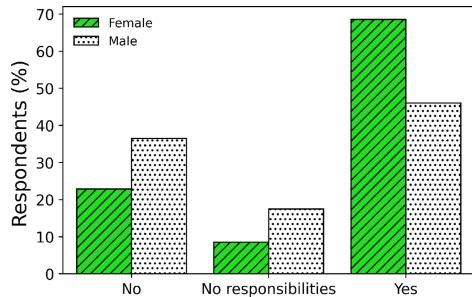
The female doctor's response alludes to how gender disparities in Pakistan's society persist, whereby her husband was in control of deciding whether or not she could work during the pandemic, limiting her agency to go to work. An analysis of the burden of household responsibilities on doctors who participated in daily chores is given in Figure 1(a) which depicts that more female doctors (about 54.3%) than their male counterparts (about 44.4%) were worse off during the pandemic, and the pandemic's effect on the burden of household responsibilities did depend on gender  $\chi^2(3,387) = 15.9, p = 0.001$ . This result was calculated using chi-square test of independence.

Female HCWs also argued that an "inherent" inclination toward caregiving led them to shoulder more household responsibilities than their male counterparts:

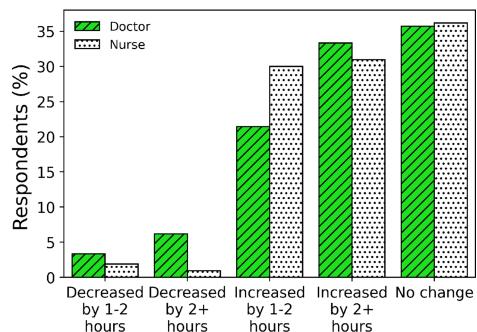
*It is obviously very difficult for us to maintain a balance between both housework and job. I have to take extra care and isolate myself from my family, especially children so that they do not contract the virus from me. If mothers get infected with the virus, they rarely have anyone to take care of their children and are still worried about their children's health more than they worry about themselves or their jobs. (P.31)*

Analyzing married survey respondents' answers again using chi-square test of independence showed that married female doctors had to bear a disproportionate burden of domestic work than married male doctors  $\chi^2(3,133) = 7.9, p = 0.004$ . However, responses of participants whose marital status was single revealed insignificant differences in changes in burden of household responsibilities.

The survey respondents were asked to report the burden of their work on a scale of 0–5 for seven different equally weighted categories of household work both before and during the pandemic. These categories included child care, sick and elderly care, cleaning, cooking, teaching, washing and home repairing/fixing responsibilities. The categories chosen were based on the household chores surveyed in [48] and [49] but were adapted for the Pakistani context; "sick and elderly" care was polled since many households in Pakistan have a joint family structure where married couples live with their parents. The difference in scores, before and during the pandemic, was taken to obtain a value for an increase or a decrease in the amount of household work, and the mean score was calculated for male and female survey respondents. A positive value specified a rise in the burden of household work, whereas a negative value denoted a decrease (the maximum and minimum possible scores were 5 and -5). The mean score for female and male HCWs was 2.8 and 0.8, respectively. An analysis of males' and females' scores using Mann-Whitney *U* test indicates that the burden of performing household tasks increased for both male and female HCWs, but it was significantly higher for female HCWs ( $U = 32953, p < 0.001$ ). Figure 1(d) depicts the mean scores of female and male HCWs in each category. A consistently higher score for female HCWs is observed in all categories of household work, suggesting that they bore a disproportionate burden of household responsibilities.

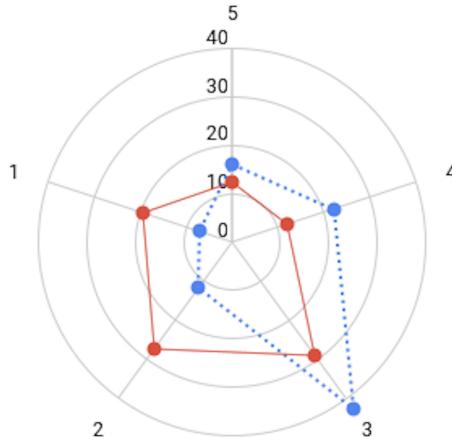


(a) Responses by married participants to the question: "Has it become harder to balance professional work with domestic work for you during the pandemic?".



(b) Changes in workload during the pandemic, as reported by the surveyed doctors and nurses.

● Before Covid-19 pandemic ● During Covid-19 pandemic



(c) Comparison of burden of workload before and during the pandemic. Labels along the radius denote the percentage of people and labels along the rotation of the circle denote burden of workload from 1 (Extremely burdensome) to 5 (Not burdensome at all).

Fig. 2. Impact of pandemic on burden at workplace.

## 4.2 Workplace Challenges

As HCWs, particularly females, strived to meet the increasing demands of their household obligations, they felt its adverse implications on their work-life balance. Nearly 48.5% of female and 41.8% of male survey respondents reported that it had become increasingly difficult to handle work and household responsibilities. While the female survey respondents argued that the COVID-19 pandemic had worsened their situation, the resulting significance was not enough to justify that females dealt with more arduous circumstances while managing their work and domestic duties. On the contrary, married men and women differed greatly in their responses as shown in Figure 2(a). Married female HCWs were impacted adversely compared with married male HCWs  $\chi^2(2,133) = 7.1, p = 0.03$ .

Several policy changes, such as setting up COVID-19 designated wards, mandated by the government and hospital administrations were implemented in healthcare facilities to tackle the

COVID-19 pandemic. These changes affected the everyday lives of the HCWs, who reported increased time on duty and significant changes in their workload at the hospital. Figure 2(c) compares the burden of work on HCWs before and during the pandemic reported on a scale of 1 (Extremely burdensome) to 5 (Not burdensome at all). The area falling under the pre-pandemic curve occupies space that is the closest to 3, 4, and 5, while the during-pandemic curve covers areas that are closest to 1, 2, and 3, indicating that there was a major shift in the work burden for participants after the pandemic began. The statistical significance of the results was verified through Wilcoxon Signed Rank Test  $Z = 38721, p < 0.001$ .

Similarly, according to 66.6% of the interview participants, the overall burden at work increased during the COVID-19 pandemic, and they suggested different reasons for it. For instance, a female doctor at one of Lahore's biggest public hospitals, criticised the closure of the **outpatient departments (OPDs)**:

*Even if the OPD closed down for a few days, patients' ailments could become more severe. As a result, the burden on the ward would increase due to a higher number of very critical patients. This could lead to the system's eventual collapse. (P.28)*

Approximately 30% of all doctors and nurses among the survey respondents reported an increase in on-duty time of more than 2 hours, while more than 50% of all doctors and nurses reported an increase of at least 1 hour, as shown in Figure 2(b). Although trivial in comparison to the majority survey respondents, who reported an increase or no change in duty hours, a considerable proportion of ~9.5% doctors and ~3% nurses experienced a decrease in their duty hours. Responses from the interviews revealed that the workload and level of responsibility varied based on the department that they were assigned. Therefore, doctors and nurses working in certain departments often benefited as the patient inflow shifted to other wards. For some HCWs, the apparent decrease in workload was due to the closure of certain departments due to the COVID-19 pandemic:

*Workload did decrease as the number of OPD patients we could treat in a day was capped to 50. This greatly reduced the patient inflow. However, comparatively, the workload is lesser but there is more tension, more problems and we have to take more precautions and safety measures. (P.26)*

Following preventive measures necessitated that there were fewer than usual doctors and nurses doing rounds. However, this meant that they slowed down their pace of rounds and did not address non-emergent or time-sensitive cases. On the contrary, some departments had to bear a disproportionate inflow of patients. According to one of the male doctors at a private hospital:

*The burden especially increased in the Ear, Nose and Throat (ENT) ward. Anybody who has Covid-19 symptoms is first referred to the ENT ward for initial check-ups and treatment. (P.6)*

The experience of changing workload was not differentiable on a gendered basis. Figures 3(a) and 3(b) show that male and female doctors experienced similar levels of work both before and during the pandemic, exhibiting no significant differences. Moreover the reported changes in their duty hours were not statistically significant as well. On the contrary, doctors and nurses vastly differed in their experiences of changing workload due to the pandemic. Figure 4 reveals that before the pandemic, the distribution of doctors and nurses across different levels of workload were equal, but a substantially larger percentage of nurses reported 1 and 2 levels of workload during the pandemic, indicating a bigger increase in their burden of labour than doctors as verified by the Mann-Whitney U test( $U = 19177, p = 0.01$ ). A female nurse believed that nurses stepped up and were more responsible than doctors, and the same pattern was repeated during the pandemic.

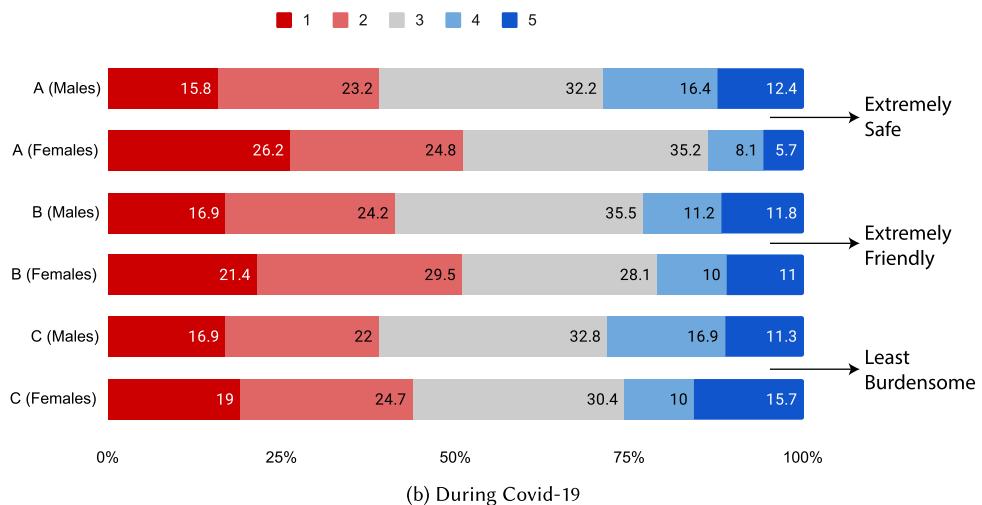
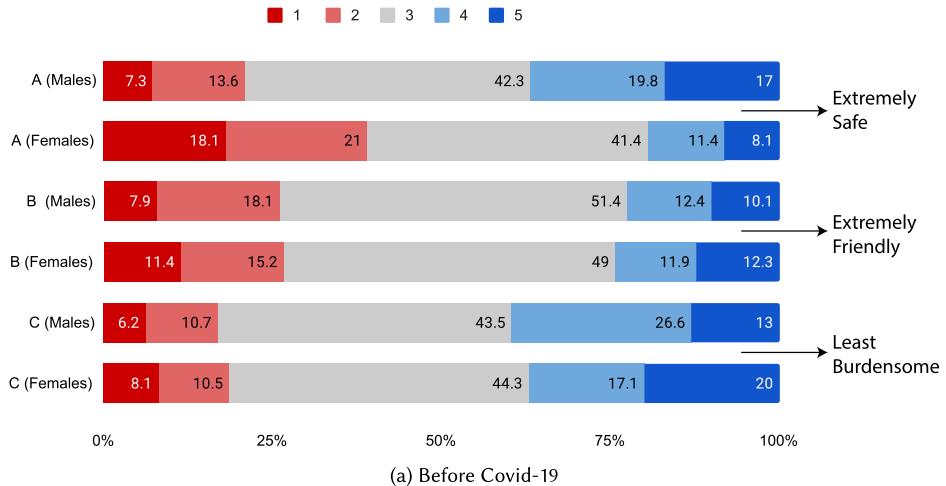


Fig. 3. Comparison of male and female doctors' answers for: (A) How safe did you feel doing a night shift before and during the pandemic? (B) How was the attitude of patients and their family members before and during the COVID-19 pandemic? and (C) To what level did your tasks/responsibilities at work feel burdensome to you before and during the COVID-19 pandemic?

Contending that nurses are crucial in running the hospital and highlighting the discrepancies in the distribution of workload between doctors and nurses, she exclaimed:

*The doctors usually instructed us to remain in the wards and they themselves would go and sit in their offices. It was imperative for both the doctors and the staff to stay in the wards (not only the staff) because everyone was employed there and had some responsibilities on their shoulders.* (P.11)

After the onset of pandemic, the attitude of attendants toward the healthcare staff deteriorated as they dealt with the trauma of seeing their loved ones afflicted and the burden of spreading COVID-19 from the hospital to others. Fueled by the government's inadequate measures in dealing with the

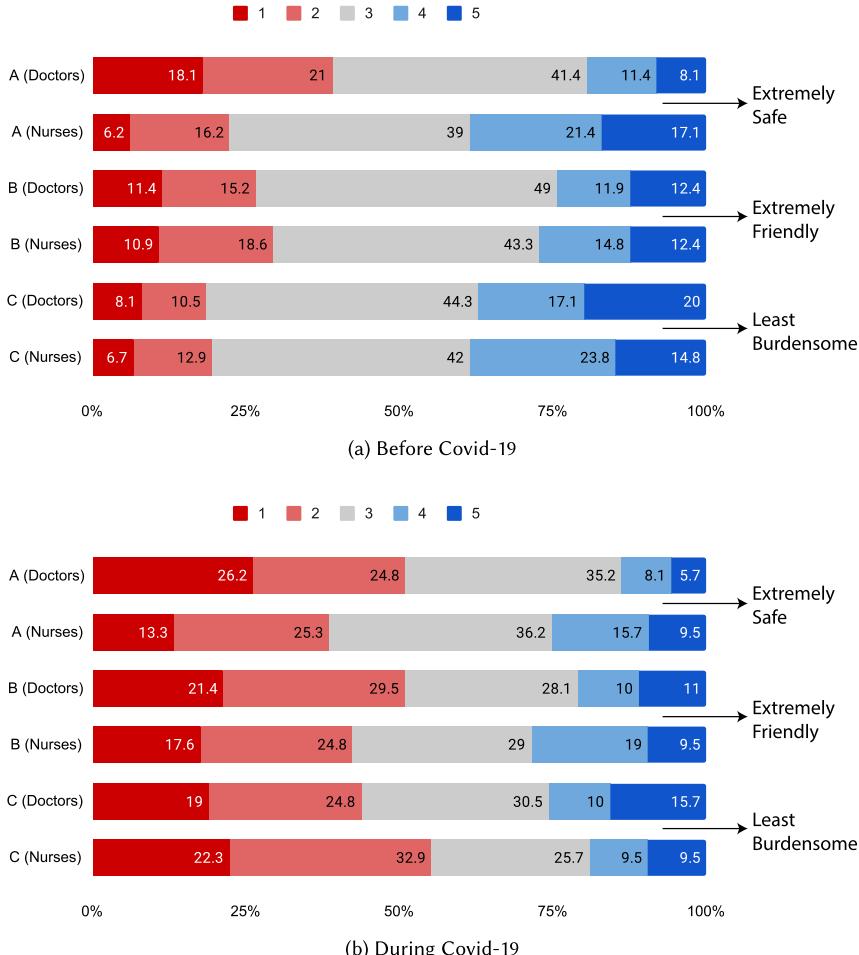


Fig. 4. Comparison of female doctors and nurses' answers for: (A) How safe did you feel doing a night shift before and during the pandemic? (B) How was the attitude of patients and their family members before and during the COVID-19 pandemic? and (C) To what level did your tasks/responsibilities at work feel burdensome to you before and during the COVID-19 pandemic?

pandemic and lack of trust in doctors augmented through misinformation about the virus brought a major negative shift in attendants' and patients' behaviors. A male doctor at Jinnah Hospital, a popular public hospital in Lahore, described the locals' dwindling trust toward them:

*Sometimes, when the patient could not recover even after receiving inhibitors and died, their relatives would accuse the doctors of killing them. A propaganda also started on social media sites that the government is receiving foreign aid as a result of a higher number of deaths in the hospitals due to Covid-19. (P.27)*

Continuing to describe how stressful and challenging it was to counsel those who had lost loved ones to the virus, he stated:

*You do your best to heal patients, but one of them dies, and their attendants argue with you, claiming that the doctor poisoned them. A 19-year-old patient died*

*recently in Jinnah Hospital, and the patient's family filed an FIR against my colleague, alleging that their patient was purposefully murdered by injection and that the hospital is now refusing to discharge the dead body. Now, my colleague is at a loss on what to do. (P.27)*

According to the interviews and surveys, female doctors, in particular, dealt with rude and offensive patients on a higher degree than males. Female reports of negative attitudes of attendants and patients rose significantly after the pandemic as compared to their male counterparts. According to Figure 3 26.6% and 50.9% females reported that the behavior of patients and their attendants was extremely negative or negative before and during the pandemic, respectively. In comparison, male doctors experienced more deteriorating attitudes during the pandemic as well but still fared better than females, as verified by the Mann–Whitney  $U$  test( $U = 20932, p = 0.02$ ).

Additionally, the experience of handling misbehavior was more frequent and adverse for doctors than for nurses. Figure 4(b) shows that 26.6% and 50.0% doctors reported that the behavior of patients and attendants was extremely negative or negative before and during the pandemic, respectively, while 29.5% and 42.4% nurses reported on these levels before and during the pandemic, respectively. This inference was drawing using the Mann–Whitney  $U$  test( $U = 19395, p = 0.02$ ). Female doctors predominantly felt that patriarchal norms and regressive gender roles allowed patients and attendants to disregard female doctors' diagnoses and treatment. Moreover, the negative attitudes the female doctors had to deal with were further escalated during the pandemic due to patients' grievances as well as proliferating misinformation about COVID-19 being a hoax and rumours that doctors were purposely diagnosing patients with COVID-19 for monetary gain.

A female doctor described the discriminatory attitude of patients:

*Patients and attendants are more rude and aggressive towards female doctors than male doctors. They are aware that men might treat them similarly if they are aggressive towards them. However, they don't think females would respond, so they continue to be disrespectful. People often do not regard female doctors as legitimate doctors and refer to them as "nurse". If a patient notices that you have a junior male doctor with you, he will choose to get checked out by him over a female senior doctor. You are powerless to intervene, because this is the prevailing cultural norm. (P.6)*

The progressively worsening attitudes of patients and their attendants laid the stage for a more dangerous and unsafe workplace for HCWs. Safety levels of the entire staff took a sharp decline when instances of violence by aggressive attendants started taking place. When attendants would learn that their family member has died as a result of COVID-19, they would become enraged and destructive and exhibit aggression upon being denied permission to meet the patient. Instances of violence make especially vulnerable groups like female staff particularly exposed to harassment. A male doctor, recounting an experience of his female colleague, said:

*When one of the Covid-19 patients died, our female colleagues was on duty. The patient's attendants were so violent that she felt threatened that they could physically harm her. One of our male coworkers was notified, and he came over and the problem was resolved. People have broken down the glass windows of wards several times, and the video recordings are available on social media as well. (P.19)*

The unprecedented danger levels in hospitals impacted the staff working night shifts where there was minimal staff and security and a higher risk of violence. When male and female doctors were inquired about how safe they felt doing a night shift, 38.9% female doctors reported feeling unsafe or extremely unsafe as compared with 20.8% male doctors before the pandemic while 50.8%

female doctors felt unsafe or extremely unsafe as compared to 38.9% males during the pandemic, as shown in Figure 3. Survey respondents' perceptions during night shifts fell significantly for both the genders, though women perceived higher threat levels both before and during the pandemic. The interviews participants provided mixed responses when inquired about their safety levels during the night shift. Many female doctors expressed concern and distress over the fact they were provided inadequate security and needed the presence of a guard to make them feel protected. One of them narrated:

*There have been occasions where attendants have beaten up doctors, as well as many incidents of harassment of female doctors and personnel. So, without a doubt, our safety is jeopardised. (P.17)*

Doctors demonstrated higher levels of safety risk than nurses according to the inference drawn using Mann–Whitney U test ( $U = 17395, p = 0.04$ ). Figure 4 shows that 39.90% doctors and 22.2% nurses reported feeling unsafe before the pandemic while 50.8% doctors and 38.5% nurses reported feeling so during the pandemic. Doctors were primarily the bearers of bad news to patients' families, alongside giving the instruction that prevented the families from meeting their patient. Hence, doctors were at a higher risk of violence and hostility. On the other hand, while a higher proportion of nurses reported feeling unsafe during the pandemic than before, their safety was still far greater to that of doctors. A female nurse who worked night shifts at a male ward described her experience:

*The patients would usually ask to turn off the lights so that they could sleep well. We, as the staff, were instructed to remain inside the patient's ward for the whole night. Staying in a male ward with no lights on was very uncomfortable for us as females. Although no patient created any sort of disturbance for us, as females we were bound to remain cautious. There were no cameras in the ward either. Later we asked them to install the cameras. The absence of cameras made the environment very unsafe for us, and it was very frightening to work at night. (P.11)*

The interviews also shed light on the challenges faced by pregnant HCWs, who continued working in the hospital during the pandemic. Hospitals did not have uniform policies for pregnant HCWs; some hospitals granted paid maternity leave to pregnant HCWs whereas others did not. Pregnant HCWs reported switching jobs to continue working due to the financial crisis that ensued the pandemic. Also, they did not want their training to be hampered due to the maternity leave. A female doctor, who was pregnant at the time of the pandemic, alluded to why she continued working:

*I left my job at the previous hospital because I got pregnant and that hospital had a policy whereby pregnant workers were not allowed to work. I could not leave my job because of the high unemployment rate in the country. I did not want to lose an opportunity that could harden my financial position. Therefore, I spoke to the administration in the current hospital, where I am working, and I was allowed to work here. (P.12)*

Hence, even though the workload increased for both male and female HCWs amid the COVID-19 pandemic, the brunt of the issues related to safety and patients' behaviors for the most part fell upon female HCWs. Even though the hospital administration at two of the largest public hospitals tried resolving safety challenges by installing cameras and keeping security guards, the attitudes of patients and the attendants toward female HCWs remain precarious due to gender norms. Further, pregnant HCWs, with inadequate support from the hospital administration, continued working

Table 2. How Worried Do You Feel About Others Avoiding You Due to the Risk of Infection Transmission?

	<b>Doctors</b>	<b>Nurses</b>
<b>1 (Not worried)</b>	32.4%	12.9%
2	17.6%	19.5%
3	20.0%	24.3%
4	13.8%	19.0%
<b>5 (Extremely Worried)</b>	16.2%	24.3%

during the pandemic even though they were at high risk of experiencing complications from the virus that could affect their pregnancy.

#### 4.3 Pandemic-Induced Stress and Psychological Burden

Doctors and nurses at public and private hospitals experienced severe psychological stress during the pandemic. Its primary causes ranged from working long hours, managing heavy patient loads, and the constant anxiety and stress about contracting COVID-19 and passing it on to others, especially their family members and friends.

Doctors, who were first assigned to the COVID-19 ward at the onset of the pandemic, refused to work because they were afraid of getting infected with the virus. There was uncertainty and risks surrounding the virus, and information about it kept evolving. A male doctor at a private hospital in Lahore recalled:

*It was quite stressful to work during the pandemic. My first colleague passed away at the end of the first wave, followed by more deaths in Lahore and Karachi. Many people applied for leaves and got their duties changed. (P.29)*

Aligning with the survey responses, the interviews also reveal that doctors were increasingly worried about keeping their family members and friends safe. The survey respondents were given a Likert scale to indicate how worried they felt about their family members and close friends avoiding them due to fear of transmission. As shown in Table 2, 30% of doctors and more than 43% of nurses expressed high level of concern. It is interesting to note that 32% of doctors, as compared to a meager 13% of nurses, opted for the option “Not worried at all”. The survey respondents were also asked if they were worried about transmitting the virus to their family members. More than 70% of both nurses and doctors expressed concern about the safety of their loved ones. Furthermore, frequently watching patients and coworkers in a critical condition as a result of the COVID-19 virus was traumatic for them. More than 60% of doctors and nurses found it disturbing to see patients/colleagues become ill/die due to COVID-19.

HCWs who had to go back home would stay in isolation to prevent the virus from spreading. During an interview, a female doctor revealed:

*I'm always afraid that my friends and family may catch the virus from me. It has happened before, and it was extremely stressful and distressing. I have to isolate myself because I am a potential carrier of the virus. Since I cannot meet my relatives and my friends like I used to, I feel depressed, alone, and distant from everyone else which puts a lot of emotional stress on me. (P.1)*

Interestingly, some of the doctors whom we interviewed lived in the hospital dormitory, away from their families, and believed that living on the hospital premises was beneficial. A male doctor claimed:

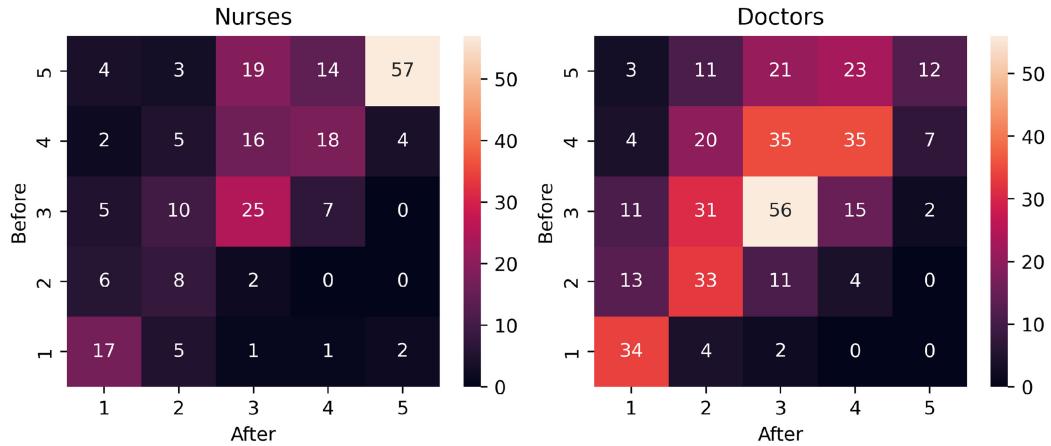


Fig. 5. Anxiety, as expressed by doctors ( $n = 387$ ) and nurses ( $n = 213$ ) on a rating scale, of their overall health (mental, physical, and emotional) in the start of the pandemic (vertical axis) as compared to a year after (horizontal axis) its passing  $\chi^2(8,600) = 19.29, p = 0.01$ . Heat-map values represent a respondent count. Options “1” and “5” denote “Not anxious” and “Extremely anxious”, respectively.

*There was a lot of fear and stress at the start of the pandemic. Even though stress levels have decreased over time, day scholars still have it tough. The safety of all of their family members is jeopardized upon their return. Some of my seniors simply would not meet their children. (P.22)*

In addition, the survey respondents were required to indicate on a rating scale how worried were they about their overall mental, physical, and emotional health right now as compared to the start of the pandemic. Figure 5 shows a pair of heat-maps that summarizes the answers of doctors and nurses. Out of a total of 213 nurses, 56 expressed that they were “Extremely worried” in the start of the pandemic as well as one year into the pandemic. On the contrary, 57 out of 387 doctors chose option number “3” on the 5-point rating scale.

The survey responses depict that female HCWs found it more traumatizing to watch their patients and colleagues die from COVID-19. Nearly 54.3% of male doctors and a total of 70.5% of female doctors reported that their experience was extremely or very disturbing. Similarly, 6.2% of male doctors as compared just 1% of female doctors found it not disturbing at all.

Added psychological burden came from the shortage of PPEs, ventilation problems caused by wearing PPEs for long durations, and transportation issues during the lockdowns.

During the first wave of COVID-19, the HCWs across Pakistan protested due to lack of PPE kits, masks, and necessary equipment required to avoid the virus and treat patients, increasing the challenges and stress that HCWs faced as they were increasingly testing positive for the virus. A male doctor recalled the problems related to the scarcity of PPE kits and masks that HCWs had to encounter:

*We were given one mask for 14 days due to shortages, which was extremely stressful and difficult to use. (P.27)*

From the interviews, it was gathered that female HCWs, in particular, found the PPE kits uneasy, suffocating, and inconvenient, impeding their ability to work comfortably. As a female doctor stated:

Table 3. How Worried Are You About the Pandemic's Financial Impact?

	Doctors	Nurses
<b>1 (Not worried)</b>	26.7%	29.0%
2	20.5%	13.3%
3	24.3%	17.6%
4	17.6%	14.8%
<b>5 (Extremely Worried)</b>	11.0%	25.2%

*It is very hard to wear three masks, PPE kits, and goggles in extreme heat. Tying hair in a bun and wearing PPE kit on top on a headscarf for female HCWs is also exceedingly difficult. If any design changes in PPE kits are possible, they should be made. (P.30)*

To reiterate, both male and female HCWs experienced psychological burdens due to the uncertainty underpinning the virus, the risk of spreading it to loved ones, and issues related to wearing PPE kits and masks and transportation. However, the quantitative and qualitative findings revealed that female HCWs were comparatively more stressed out while dealing with COVID-19-infected patients due to the fear of passing the virus on to others. Moreover, they found it increasingly difficult to wear PPE kits and to be able to get to work on their own, owing to their dependency on male family members for transportation and lockdowns.

#### 4.4 Financial Impact

Another shared experience for the HCWs relates to the financial effects of the pandemic. They generally expressed worries about their financial situation stemming from the impact of COVID-19. For female respondents, Table 3 shows an interesting comparison between doctors and nurses: more than twice as many nurses as doctors were extremely worried that the COVID-19 pandemic would have a negative impact on their financial situation. This indicates how nurses perceived their vulnerability to be far greater than that of doctors. While the majority of survey respondents stated that their monthly household income did not change as a result of the pandemic, ~30% doctors and ~26% nurses reported a decline in their monthly household income, as shown in Figure 6(a). Interviewee accounts suggest that this could be attributed to male spouses of some female HCWs losing their jobs or businesses due to the recession incurred by the pandemic. The latter is supported by Figure 6(b), which depicts more than 85% of HCWs did not experience a change in salary.

HCWs were also required to purchase their own PPE kits and masks, especially at the start of the pandemic due to the nationwide shortage, resulting in an increase in their day-to-day expenses, as shown in Figures 6(c) and 6(e). Despite this increase, which was reported by over 50% nurses and approximately 40% of doctors, a significant majority received the same salary during the pandemic as before it according to 6(b).

Moreover, more than 40% of doctors and 55% nurses reported an increase in their transportation expenses, while more than 50% of all respondents reported that buying PPE kits incurred additional expenses, as shown in Figures 6(d) and 6(e).

In addition to the closure of public buses and vans, ride-hailing applications and cab services became less popular due to the fear of COVID-19 transmission, but for HCWs who did not own a means of transportation, these were suitable options, albeit pricey. According to a female nurse:

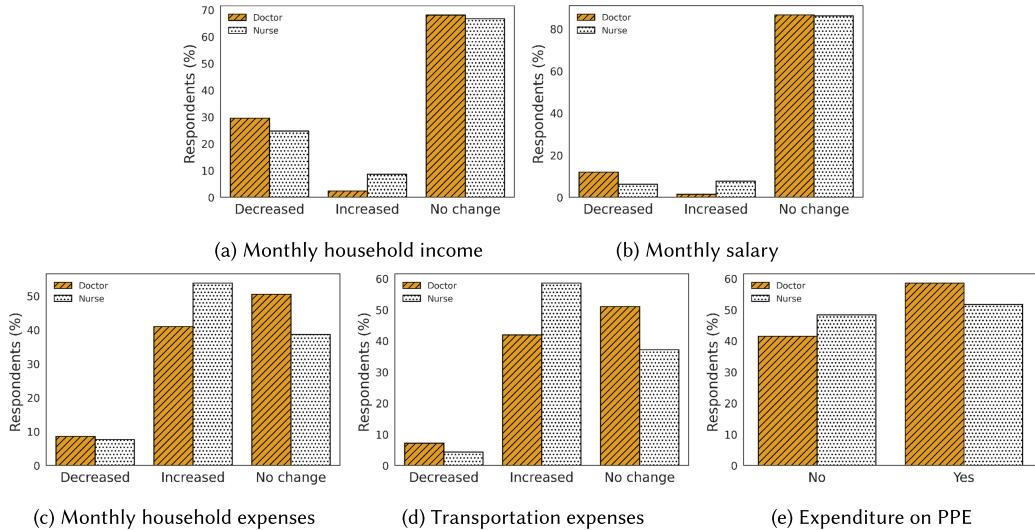


Fig. 6. Financial impact of the COVID-19 pandemic on doctors and nurses.

*Everything was easily available before the pandemic. It was easy to get transportation at any time as a single working woman, but now I had to hire a permanent rickshaw driver, who demanded a higher fare due to distance and time issues. Nearly 30% of my total salary got spent on paying for transportation during lockdown. (P.16)*

It is worth bearing in mind that it is primarily men who use family-owned cars in Pakistan, leaving women to depend on their male family members for pick up and drop off or they had to opt for public modes of commuting, which they avoid using due to fear of harassment. Several (but not all) hospitals provided their staff with a pick and drop facility, leading to a decrease in transportation expenses for nearly 10% of the HCWs, as shown in Figure 6(d).

The survey responses visualized in Figure 7 indicate that male and female HCWs may have been impacted differently. According to Figure 7(a), the proportion of men who had to take additional loans during the pandemic was twice the proportion of such women. In Pakistan, men are socially expected to be the primary breadwinners of the family. However, the findings provide strong evidence that female HCWs played an unconventional role of not only covering their own expenses but financially supporting other family members or acquaintances. Figure 7(d) depicts that an equal percentage of male and female HCWs were supporting at least one individual who had lost his or her employment during the pandemic.

Although the government and hospital administration did not increase HCWs' salaries, non-governmental organizations were able to provide some relief. As a doctor at a public hospital contended:

*Our salaries were raised by 10 to 20% through donations from two non-profit organizations, not by the hospital administration or the government. (P.22)*

Some departments of the hospital were closed down to accommodate as many COVID-19 patients as possible. This resulted in smaller shifts and a subsequent decrease in salary for some workers.

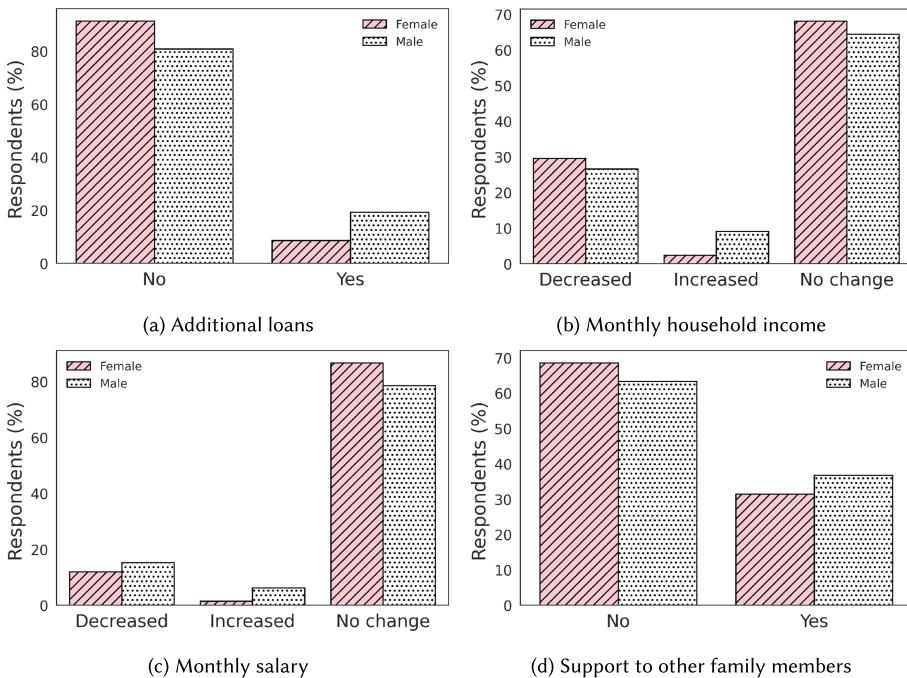


Fig. 7. Financial impact of the COVID-19 pandemic on female and male respondents.

Furthermore, salary increments were promised at the start of the pandemic but never implemented:

*The government declared that healthcare professionals would receive allowances and higher remuneration for their services, although this is yet to be implemented. It was nothing more than a government publicity stunt. (P.26)*

The financial impacts of COVID-19 were broadly felt by the HCWs, especially during the first wave. Their daily expenses increased due to PPE shortage and rising transportation costs, even though most of them did not experience a change in salary, causing male HCWs to get loans. The HCWs expressed disappointment at the government for not providing salary increments despite assuring them to do so. Additional support came from non-governmental organizations that were able to alleviate some of their financial pressures.

## 5 DISCUSSION

In this section, we will begin by providing a broad summary of our findings and connecting them to prior research. Drawing on our results, we will then pinpoint the key challenges faced by HCWs and discuss how our study can guide the design of technological and policy initiatives to tackle those challenges.

### 5.1 Summary of Findings

Recent research has widely established that HCWs comprising doctors, nurses, and healthcare staff, have been on the frontline of the fight against the COVID-19 pandemic, risking their lives to keep people safe and alive [50]. However, their experiences are varied due to cultural aspects, including norms, beliefs, and values that may view women as inferior to men. In contexts where

disparities and discrimination account for limitations of living and well-being, women tend to be more significantly impacted [14]. Even before the COVID-19 pandemic, female doctors reported experiencing role conflicts as they struggled to manage work and family roles and advance in their medical careers [51]. Early evidence has also shown that work-family conflict and associated emotional exhaustion [52] and depression [53] are more common among female HCWs than male HCWs.

The HCWs' overall experiences during the pandemic, as noted in our study, largely corresponded with results from other studies on similar topics, depicting that the HCWs' experiences are shared worldwide [44, 54–56]. Regardless of their gender, they felt burdened by extended working hours, limited knowledge of the virus, uncertainty underpinning the pandemic, PPE shortage, fear of being infected and infecting loved ones with COVID-19, and financial impacts.

The female HCWs reported that they struggled with managing rising domestic duties stemming from their combined roles as mothers and wives. Household chores, such as cooking and cleaning, can still be aligned around work schedules and be shared because seeking help from family members is prevalent in Pakistan, but caring for children may lead to barriers in work and occupational mobility [57]. In line with recent research [27, 58], we also found that the COVID-19 pandemic led to an even greater disparity with female HCWs managing unpaid caregiving demands and looking after their children and the elderly, impacting their working hours and causing stress and anxiety. We observed an increased gender difference in caregiving, especially for mothers in the health-care workforce, as they struggled more than their colleagues to balance responsibilities at work and home. On the other hand, married couples without children reported sharing housework relatively equally. Equality among couples decreases as they become parents because devotion to children is considered an indicator of a “good woman” as per gender norms in society [59]. Moreover, the transition to parenthood entrenches women's responsibility for unpaid domestic work, despite being medical doctors and nurses, and men's for paid work. Therefore, while married couples' time allocation might be alike, the patterns change when they become parents, burdening mothers more than fathers [51].

Furthermore, at work, the female HCWs in our study reported having experienced more exhaustion and depression during the pandemic than before due to the fear that they would bring COVID-19 home, causing significant implications for the well-being and productivity within their family. Additionally, we found that the career trajectories of a few female HCWs were often dictated by their family members, especially husbands, who would push them to leave their risky and time-consuming jobs. Female HCWs were further disadvantaged as they struggled to meet the demands of patients who preferred male HCWs over them. Transportation was also a matter of concern for them, as they relied on their male family members for conveyance. Consistent with prior work on female physicians juggling medical, maternal, and spousal roles [60], we found that it was common among pregnant HCWs to take too short a maternity leave. They did so to stay in the workforce despite the pandemic to avoid experiencing long-term repercussions, such as delayed promotion and increased salary cuts, which added to their stress and health risks in the pandemic's context as they came to work while pregnant.

## 5.2 Technological and Policy Initiatives

In light of our findings, we now identify specific challenge areas/domains relevant to our study. We also propose specific policy guidelines and technology interventions that are intended to be taken by governments, organizations, and researchers who are exploring ways to create more inclusive workplaces. When implemented and deployed, our proposed guidelines and interventions may lead to unique additional insights; we deem these as separate lines of work for further exploration in future studies.

**5.2.1 Parenting Challenges of Online Learning.** Parenting in the era of online learning poses unique challenges. Participants raised two primary concerns on this front: (1) Parents had to provide extra support and guidance to their children who could not manage online classes on their own, and (2) Parents found themselves in a difficult situation where the hours for their professional duties and their children's online classes overlapped, making it difficult to provide the extra supervision required.

To tackle the first concern, teaching methods can be revamped to promote students' participation, self-motivation, and concentration in class. Two such methods, that the local school system can adapt to rather easily, are (a) the use of in-class group-based activities, which encourage peer-to-peer learning, instead of individual take-home assignments that would have required extended parental assistance, and (b) gamification of the teaching content that has been shown to hold great promise in enhancing learning outcomes such as engagement, student motivation, and performance [61–64]. Designs of gamified teaching activities can be iteratively evolved by measuring student focus and learning outcomes for specific content (language, skills, science, etc.) and specific setups (online, in-person, or hybrid). However, it is important to recognize that challenges specific to resource-constrained areas can hinder the transition to remote learning, particularly during times of crisis when there is a sense of urgency and limited time for preparation, as highlighted by Ravi et al. study on the shift to remote learning during the pandemic in India [65]. Not only do they identify these challenges, but also outline viable and practical workarounds to overcome them. For instance, their findings revealed that in those regions of India where internet connectivity was scarce, students were taken to nearby centers equipped with reliable internet access in small groups. This ensured effective and equitable resource sharing in a safe way. Therefore, it is imperative to take into account context-specific challenges and adapt interventions accordingly.

To address the second concern of HCWs, we propose the deployment of algorithmic shift planning systems in hospitals, which could generate custom need-based schedules for them. Such context-aware scheduling systems can be quite effective by catering to user preferences and facilitating employee cooperation to accommodate each other if and when scheduling conflicts arise. For instance, HCWs facing unavoidable circumstances, such as caring for school-going children in the morning (due to school closures), could swap their duties with colleagues who do not have similar responsibilities, instead of taking the day off. While workers have been shown to informally use a similar but manual method with their coworker friends, an automated algorithmic scheduling system could constantly monitor the needs and opportunities for shift exchanges across the organization in real-time, streamlining the process, extending it beyond the circle of coworker friends, and ensuring optimal results [66].

**5.2.2 Uneven Distribution of Domestic Workload.** As depicted in Figure 1(d), female HCWs faced a disproportionately higher increase in domestic workload than male HCWs across all categories of household tasks during the pandemic. Female interviewees reported being primarily responsible for childcare duties even during COVID-19 times, making it challenging for them to balance work and life. Consequently, our findings suggest that female HCWs bore a significantly greater burden of domestic responsibilities compared to their male colleagues.

To achieve a fairer distribution of domestic duties, it is crucial for all adults in the household to have a systematic awareness and understanding of the responsibilities that fall disproportionately on women. One potential solution is the use of mobile applications that record each household member's activities, assign them a score based on the duties they have completed, and offer rewards such as the ability to assign their chore to another member. This would enable everyone, particularly women, to keep track of how much they and others have contributed to domestic tasks [31]. By increasing transparency and awareness of household task distribution, these applications

could empower women to hold others accountable for their share of the workload. However, this approach assumes that all household members recognize and value an equitable division of labor. In societies where achieving an equitable distribution of household tasks is an ideological challenge rather than a practical one, the effectiveness of such applications may be limited.

**5.2.3 Inadequate Security Measures.** Our qualitative findings revealed that female HCWs were subjected to threats from patients' relatives. Furthermore, over 50% of female doctors in our survey expressed concerns about their safety while on hospital premises during the pandemic. Female HCWs facing threats from patient attendees often rely on male colleagues for assistance. In such a situation, the response time is critical. One method could be to deploy a mobile-based emergency button that notifies both colleagues and security personnel about the situation. A hospital-wide implementation of this service would provide ubiquitous and prompt emergency response. In 2017, a cell phone based panic button was deployed in India to ensure women's safety in public spaces after a brutal gang rape took place in New Delhi. Through a feminist lens, Karusala et al. explored Indian women's perspective on personal safety and the effectiveness of the panic button, discovering that the system's design was not ideal for use by women [67]. They shed light on implications for designing and ensuring the success of similar emergency response systems in the future. These design implications could prove useful in our scenario as well.

The lack of CCTV cameras in hospital buildings, as reported by our interviewees, also highlights the inadequacy of current security measures. To address this issue, we suggest implementing CCTV surveillance alongside **algorithmic decision support (ADS)** systems. ADS systems employ multi-system administrative data to enhance human decision-making, particularly in situations that involve human screening [68]. Hospitals can utilize ADS as a preemptive security measure by screening attendees who come to the hospital to visit their patient for a history of misbehavior or violence; based on the results of the screening and using live CCTV footage, security or surveillance could be increased, and localized to specific wards or buildings that the target individual is in. For a hospital setting, multi-system administrative data could include individuals' mental health records, past complaints of misconduct in the same or another hospital, and criminal history—all of which can be readily made available from government databases or shared amongst hospitals. ADS has been previously adopted in a bunch of social settings, including healthcare [40], education [69], social work [70], and municipal systems [71]. However, it is critical to remember that ADS must be guided by its limitations and augmented with rich contextual information that may not be available to ADS systems but is accessible to the human officer operating them [68]. Therefore, it would be useful for future researchers to examine not only the need for ADS, but also the privacy and fairness concerns pertaining to its use in a hospital setting.

**5.2.4 Lack of Public Trust.** Misinformation about COVID-19 has led to a lack of trust in doctors, particularly in female HCWs; this has adversely impacted patients' and attendants' behavior with HCWs [22, 72]. Leveraging the widespread use of cell phones, pandemic-related misinformation could be combated through public service messages, calls, and ringtones. Our qualitative findings reveal prevalent misconceptions in the public regarding the superiority of male doctors over female doctors. Consequently, senior female doctors are often overlooked in favor of their junior male colleagues, and some people mistakenly refer to female doctors as nurses. While public-service calls have effectively disseminated vaccine-related information in the past, including vaccination center locations, operating hours, and the benefits of vaccines, no such attempt has been made to fight off gender-based misinformation about HCWs. We propose that the findings of our study be used to identify the most common gender-based misconceptions about HCWs and to create public service messages to address them. The widespread prevalence of mobile phones and the

universality of SMS and calls across all mobile phones makes this intervention particularly valuable in developing countries where access to other media vectors and smartphones may be limited.

*5.2.5 Lack of Hospital Resources.* Our participants revealed during interviews that hospital resources quickly depleted due to the high influx of COVID-19 patients, many of whom required hospitalization. To accommodate the high load of such patients, the administration temporarily converted some wards that they deemed as low priority, such as those for eye and skin care, to additional isolation units for COVID-19 patients. As a consequence, the pandemic resulted in a scarcity of hospital resources and limited access to medical care, not just for COVID-19 patients but also for those seeking treatment for low-priority issues. Indeed, doctors specializing in dermatology and ophthalmology reported a decrease in their workload. In our view, this situation resulted in an opportunity to promote and expand the telemedicine services, such as virtual consultation.

Previous studies have demonstrated the effectiveness of telemedicine in improving healthcare access and delivery in developing countries, providing supporting evidence for its feasibility in this context. For example, Dell et al. performed a field evaluation of their computer vision-based mobile system that could capture and analyze diagnostic tests of infectious diseases like Malaria in Zimbabwe [73]. Their research showed that not only were the system's results reasonably accurate, but HCWs in Zimbabwe also came up with a strategy to deal with weak internet connectivity, which is a rather prevalent issue in the developing world. Perrier et al., on the other hand, demonstrated how SMS-based communication could be used to offer professional, individualized medical advice to pregnant women scalably and remotely in Kenya [74]. Telemedicine could also reduce the need for in-person consultations, minimizing the risk of COVID-19 transmission [75]. During the COVID-19 pandemic, Bhat et al. conducted a comprehensive survey and interview study to examine the effects of the pandemic on the telemedicine infrastructure in India, experiences of HCWs and patients around telemedicine, and any necessary adaptations that were in place to facilitate telemedicine services during the pandemic [76]. Thus, prior work demonstrates that while telemedicine cannot replace in-person care entirely, it can indeed offer a viable alternative during times of crisis in resource-constrained areas.

## 6 LIMITATIONS AND FUTURE WORK

This study has multiple strengths, such as deploying mixed methods, comprising an extensive survey and in-depth interviews, to holistically explore the experiences of HCWs during the COVID-19 pandemic against the backdrop of existing gender norms and inequalities. However, the article should also be considered in light of some limitations. Since surveys and interviews were conducted during the peak of the fourth wave of COVID-19, we adopted a convenience sampling method to limit our exposure to the virus. Therefore, the results cannot be generalized to Pakistan's entire healthcare workforce.

Some interviews were rushed and did not produce in-depth information because the HCWs had busy and tiring schedules. As a result, they could not dedicate adequate time to answering our questions, particularly during the interviews, as they would get called by nurses to check patients, which is why there are gaps in information (e.g., missing income levels, age, and marital status for some participants) on their sociodemographic characteristics.

A future investigation could take into account the role of other sociodemographic characteristics, such as partner occupation, that may shed light on the varying burden and responsibilities undertaken by female HCWs. Future directions of work could also explore how gender norms, in a patriarchal context like Pakistan, were negotiated by female HCWs in their households and at work before and during the pandemic. Female HCWs' depiction of agency against gender role

stereotypes could assist in identifying the forms of everyday negotiations that augment their well-being, an aspect worth incorporating while designing interventions that could bridge gender gaps.

## 7 CONCLUSION

This study deploys a gender lens to examine differences in the HCWs' personal and professional lives before and during the COVID-19 pandemic in Pakistan's context. We spread our analysis across four central themes: household responsibilities, hospital duties, psychological burden, and financial impacts. We found that both male and female HCWs experienced challenges, such as a shortage of PPE kits, extended hospital shifts, increased psychological burden, and negative financial impacts during the pandemic. Female HCWs had to bear disproportionate responsibilities for unpaid care work and household tasks compared to male HCWs. However, this gender disparity was predominantly experienced by female HCWs with children. Most female HCWs felt unsafe in situations where attendants and patients turned violent toward them as they preferred being diagnosed and treated by male HCWs. Moreover, they depended on their male family members for transportation, impeding them from reaching the hospital on time. HCWs who were pregnant at the time of the pandemic delayed their maternity leave to avoid experiencing salary cuts and obstacles in their training. Furthermore, the increased frequency of deaths observed in the hospital daily and the risk of transmitting the virus to family members were identified as significant contributors to psychological stress by female HCWs. Our findings emphasize the necessity for policy- and technology-based solutions, based on humanistic, activist, and inclusive approaches, to take into account female HCWs' perspectives. Initiatives must consider the multiple impacts of existing gender disparities on the lives of female HCWs, particularly amid uncertain times, such as the COVID-19 pandemic.

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