



Imagining Caring Futures for Frontline Health Work

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Care workers are increasingly using digital technology in their daily lives, for monitoring, financial compensation, training, coordination, and more. State and corporate actors have invested significant resources to enable this digital shift, particularly during the COVID-19 pandemic. However, care work has remained chronically underpaid, and continues to rely on women from minoritized and marginalized backgrounds. Our paper examines how care workers carefully navigate digitization, precarity, and complex social relationships, in an attempt to care for their communities and each other. We analyze the emerging digital ecosystem for frontline health workers in India during the COVID-19 pandemic where these dynamics have been highly visible. Our research draws attention to four interconnected ways in which workers practiced care, by directing their efforts towards *survival*, *resilience*, *advocacy*, and/or *resistance*. We suggest these also as *care orientations* that can be adopted by researchers and practitioners, to critically reflect on and direct technology design towards enabling more caring futures, for (and with) workers and communities.

CCS Concepts: • **Human-centered computing** → **Empirical studies in HCI**.

Additional Key Words and Phrases: Frontline Health, India, Care, Future of Work, Digitization

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1 INTRODUCTION

Researchers in the fields of Computer-Supported Collaborative Work (CSCW) and Human-Computer Interaction (HCI) have long examined how technology can support care workers in traditional care settings, such as hospitals and nursing homes [17, 72]. Increasingly, scholars have also been studying care workers operating in informal spaces, such as home health aides, social workers, and frontline workers [13, 53, 90, 116]. Recent research has highlighted the significant workload on care workers across settings, and how technology can impact the care burden overall [90, 116]. The COVID-19 pandemic has also brought attention to the chronic under-investment in care infrastructures, even as there has been increased investment in digital integration and a reliance on data [34]. Frontline health workers (FHWs) in particular have seen a shift towards digital workflows

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in contact tracing, decision support, training, information delivery, and more [74]. Our paper offers an analysis of an emerging digital ecosystem for FHWs during the COVID-19 pandemic, where the interplay between care work and digital workflows has been highly visible.

An emergent body of work at CSCW and HCI focuses on the design of technology with and for FHWs, though these have thus far primarily focused on small-scale and short-term deployments by the researchers themselves or with local partners (e.g., [28, 54, 81, 122]). We study the state-driven integration of mobile technology to support various workflows of women FHWs in Haryana (India) over multiple phases of the COVID-19 pandemic. The initiative is indicative of a wider agenda by national and state government bodies in India to move towards platformized governance, such as by integrating health records with the nationwide biometric identification system (Aadhaar) as part of the National Digital Health Mission (NDHM), which began implementation in September 2021 [41, 44, 107, 108]. Corporate actors are also providing technology support to enable this mission, some of whom have called for FHWs to become digital health enablers integrated into platforms for care delivery [1, 66]. As government and corporate institutions target increasingly technology-mediated futures for care workers, our paper outlines how researchers and practitioners can play a role in centering *care* in these efforts.

Set in this rapidly evolving landscape, we ask the following questions: *How are FHWs navigating the digitization of their workflows during a pandemic, as they attempt to care for their communities and each other? How might such digitization efforts be directed to enable more caring futures for workers and the communities they serve?* To investigate these questions, we interviewed eighteen women FHWs in the state of Haryana, including Accredited Social Health Activists (ASHAs) and ASHA facilitators, whose work is increasingly moving online. Our analysis draws attention to the changing work and care demands on FHWs as a result of top-down digital integration, their experiences adopting mobile applications to support emerging work needs and to maintain continuity of care, and the conflicts with communities and healthcare actors that emerge in the process.

Our paper is structured as follows. We first lay out related literature on technology-mediated frontline health, care and the feminist political economy, and platformized governance and labor platforms in the Global South. We then detail the study context and our methods for data collection and analysis. Next, we present findings on the top-down transition to technology-mediated workflows, the social organization of care, and the labor politics surrounding the digital workflows of the FHWs. Drawing on these findings, we then discuss how FHWs engaged in care practices directed towards *survival*, *resilience*, *advocacy*, and *resistance*, to build more caring futures for themselves and their communities. We offer these as *care orientations* that may be adopted by technology researchers and designers to direct improved future(s) for frontline health, amidst the increasing digitization of care work globally.

2 RELATED WORK

Our research builds on a rich body of literature on technology-mediated frontline health, care work and the feminist political economy, and platformized governance and labor platforms in the Global South. We summarize these below.

2.1 Technology-Mediated Frontline Health Work

CSCW and HCI researchers have long been invested in the design, development, and deployment of health interventions across the Global South (e.g., [81, 87, 88]). A significant portion of this work has focused on supporting or leveraging FHWs responsible for delivering healthcare at the last mile in underserved settings, many of whom are women workers engaged in maternal and child care delivery [8]. Early research in this space by Ramachandran et al. studied the use of mobile phones by FHWs for information delivery [97]. Since then, several studies have focused on information

dissemination by FHWs in communities through videos, particularly around maternal and child health [62, 76, 117]. Researchers have also examined FHWs' mobile phone use and media-sharing practices to inform the design of these interventions, bringing attention to gendered access to mobile devices and additional challenges around enabling digital literacies [48, 54, 61]. There has also been a focus on training of FHWs, such as Yadav et al.'s research on how peer learning could be facilitated among FHWs, using IVR and smartphone applications [122, 124, 125]. This body of work has also documented the potential for technology to add legitimacy to the work of FHWs who are underpaid and under-recognized [61, 97], the value offered by mobile phones used by FHWs beyond work [48, 67], and interest among FHWs to improve their digital literacies [48, 85].

Several researchers have also designed and deployed interventions to support data collection by FHWs. Research in this area has considered the use of mobile devices for digitizing data collection and improving the efficiency of healthcare provision [14, 29, 67]. For instance, DeRenzi et al. have studied how this data can be used to improve workflows and provide FHWs with feedback on their performance [28]. Researchers have also uncovered the burden of digital data collection among FHWs [47, 85]. HCI researchers have also begun to examine the role of emerging technologies in frontline health work. Yadav et al. conducted participatory design research explored the potential for chatbots to support breastfeeding practices [123]. Ismail and Kumar have outlined design considerations for AI efforts in frontline health [49]. Okolo et al. have also studied the perceptions of FHWs for AI-based automated disease diagnosis [82]. Our study builds on this body of work to examine the large-scale, state-led deployment of mobile technology with FHWs in India, involving a rich digital ecosystem with multiple applications. We offer insight into the gaps that arise in a top-down program, the shift towards digitization and the changing nature of work for FHWs.

2.2 Care and the Feminist Political Economy

FHWs are engaged in various kinds of care work on a daily basis, such as counseling their communities on behaviors and services relating to maternal and child health, sexual and reproductive health, and primary care more broadly. Verdezoto and Bagalkot et al. have previously documented the critical work performed by FHWs in maintaining, anticipating, reconciling, and supporting care infrastructures [118]. Their role in care infrastructures merits further attention as their work gets digitized. We draw on the definition of *care* by feminist scholars, Fisher and Tronto, who describe it as “*a species activity that includes everything that we do to maintain, continue, and repair our ‘world’ so that we can live in it as well as possible. That world includes our bodies, our selves, and our environment, all of which we seek to interweave in a complex, life-sustaining web.*” [35]. This definition encompasses a wide range of care work, such as frontline health work, nursing, domestic work, housekeeping, child and elderly care, volunteer work, community organizing, and more. Within CSCW and HCI, there is a long history of research on the design of technology to support care work—in traditional care settings such as hospitals and nursing homes, as well as informal spaces such as the home, churches, and government welfare programs (e.g., [10, 17, 83, 114]). CSCW researchers have also begun to both problematize caring labor and reflect on how caring labor can sustain communities in broken and capitalist infrastructures. For example, Poon et al. have highlighted the burden of the emotional labor performed by home care workers, and the importance of peer support in professionalizing the home care profession [90]. In their study of community forms of care work to address local behavioral health needs, Kaziunas et al. point to the labor needed to maintain ecologies of care in the face of infrastructural brokenness [58]. Through a case study of a design project confronting risks of social exclusion that result from precarious labor conditions, Sciannamblo et al. discuss how the combined concepts of care and *commoning* present alternatives to capitalist accumulation [102].

The COVID-19 pandemic has also renewed focus on the entrenched racial, gender, and class inequalities in care work [11, 63]. Glenn outlines how care can be extractive and coerced through physical, economic, social, or moral pressure [37]. She draws attention to how the social organization of care has induced women to assume responsibility for caring and pushed poor, racial minority, and immigrant women into positions entailing caring for others. Coercion constrains and directs women's choices, resulting in keeping caring labor "cheap" [37]. A feminist political economy analysis of global care chains also reveals the historical, economic, political, and social relations that impact care arrangements [7]. This has resulted in the over-representation of women in work that is insecure, risky, low-paid, and poorly regulated globally [95]. Within CSCW, Raval and Dourish have previously employed a feminist political economy framing to study the emotional labor, body labor, and temporal labor that crowd work entails [98]. Our paper draws on this rich history of feminist literature to examine the political, social, and economic dynamics within which digitization of care labor is embedded, in a setting in the Global South. We highlight the extraction of care labor in the case of women FHWs in Haryana where the employment and exploitation is by the state.

2.3 Platformized Governance and Labor Platforms in the Global South

As technologies for frontline health begin to be integrated into national digital infrastructures, prior research on platformized governance and labor platforms in the Global South can help illuminate challenges that may emerge. Drawing on Poell et al., we use the term "platformization" specifically to refer to the use of platforms for the development of data infrastructures and for governance [89]. In the context we studied, we found FHWs to be engaged in extensive digital data collection. We also see demonstrated intent by the government to use digital technology and data to shape healthcare workflows on the ground. The national government has also announced its intention to create national health IDs for every citizen, linked to Aadhaar [1]. Prior work by Singh has extensively documented how Aadhaar, India's biometric national identification project, was conceptualized and set up, and how it involved the re-imagining of the Indian government as a platform of services [106]. Several studies have also documented challenges faced by Aadhaar users in registering, authenticating, and successfully deploying their registered identity, to participate in the Public Distribution System (PDS), a government scheme that provides subsidized food grains to the Indian poor [77, 108]. Singh and Jackson have uncovered how the program denies access to groups already on the margins—socially, economically, and infrastructurally [108]. Given such implications, Pal et al. argue that certain state digitization efforts should be framed within a larger undertaking of technology-driven modernity rather than productivity gains [84]. They document the limited efficiency of the Indian government's push for digital payments, an undertaking that was highly political [84]. Outside India, Jack et al.'s work has highlighted how even existing digital platforms can be appropriated by states to extend information control and authoritarian power, such as by village-level officials in rural Cambodia [50]. We build on this body of work to examine state digital efforts in frontline health.

The entry of data-driven technologies in healthcare (as in other domains), further precipitated by the COVID-19 pandemic, has also led to a shift in the nature of work and the workplace [86]. Work is increasingly online, automated, and paid on per-task basis (also known as gig work). Researchers have extensively documented the effects of platformized labor in the Global South, and how this work is frequently rendered invisible [32, 71, 91]. For instance, Gray and Suri have uncovered the invisible work that goes into making AI systems work, relying significantly on underpaid workers in the Global South [40]. Several studies have also examined how platforms for workers have been complicit in enabling financially precarious positions under the guise of offering flexible employment, by denying employee benefits and protections [42, 92, 99, 103]. Emergent research has also investigated the gendered labor politics embedded in these platforms. Raval

ID	Role	Age (in years)	Education level	Experience (in years)	Interview Phase
Meena	ASHA	39	10th standard	13	Phase 1
Anita	ASHA facilitator	44	B.A.	15	Phase 1, Phase 2
Sunita	ASHA	47	10th standard	15	Phase 1, Phase 2
Preeti	ASHA	27	12th standard	3	Phase 1
Juhi	ASHA facilitator	42	10th standard	11	Phase 1
Manushi	ASHA	37	8th standard	8	Phase 1, Phase 2
Sakshi	ASHA	46	10th standard	14	Phase 1
Sushma	ASHA	35	12th standard	3	Phase 1
Geeta	ASHA	24	10th standard	4	Phase 1
Mamta	ASHA facilitator	42	10th standard	16	Phase 1
Komal	ASHA	37	12th standard	3	Phase 2
Babita	ASHA facilitator	44	B.A.	13	Phase 2
Saina	ASHA	34	12th standard + Diploma	6	Phase 2
Kalpana	ASHA	53	10th	15	Phase 2
Pooja	ASHA facilitator	48	12th standard	16	Phase 2
Priya	ASHA	26	B.Ed.	2	Phase 2
Asmita	ASHA	33	12th standard	-	Phase 1
Reema	ASHA	32	12th standard	6	Phase 1

Table 1. Demographic information about our study participants including ASHAs and ASHA facilitators (ASHAs with additional supervision responsibilities of other ASHAs). Fields marked as “-” indicate that the information was not collected.

and Pal have documented the use of app-based on-demand platforms that aggregate beauticians and spa therapists to provide at-home services in urban India [99]. Their work demonstrates how such platforms are creating new expectations around professionalism and training, and tensions with the realities of gender, class, and caste in such care labor. More recently, Anwar et al. have uncovered how platforms for beauty work rupture dominant socio-cultural structures of control that have traditionally shaped women’s mobility and access to work, but continue to entrench power asymmetries between customers and workers, as well as maintain them between the platform and the worker [6]. We see several parallels between platform/gig work and the task-based piecework [5] that FHWs are engaged in, both of which are highly racialized and gendered and are financially precarious. Our research also shows how various technologies being introduced were complicit in the maintenance of power asymmetries and in enabling and upholding precarity.

3 METHODS

Our research goal was to understand the experiences of frontline health workers in India with the digitization of their work during the COVID-19 pandemic, and the evolution of workflows during this period. We conducted semi-structured interviews with FHWs working in rural Haryana, including eighteen Accredited Social Health Activists (ASHAs), of which five were ASHA facilitators. Table 1 presents demographic details about the participants, including their age, education level, and years of experience. Below we describe the study context and provide background on our participants, participant recruitment and data collection, and our process of data analysis.

3.1 Study Context and Participant Background

The state of Haryana has employed over 20,000 ASHAs to service around 7000 villages, with each worker assigned to approximately 1000 people [78]. They provide primary healthcare services at the last mile, particularly maternal, child, and reproductive health [73]. Their work includes door-to-door data collection, healthcare provision, community mobilization, and information distribution. Despite receiving base salaries from the national and state government (which varies across states),

they are seen as volunteers and not government employees and are hence not eligible for most benefits [73]. Their work is largely incentive-driven, being paid on a per-task or piecework basis [73]. They are assigned to a specific region or set of households and are linked to a *Sub-Centre*—the most peripheral and first contact point between the primary health care system and the community. *ASHA facilitators* are more experienced ASHAs who oversee and advise approximately twenty ASHAs, in addition to performing regular duties [73]. They receive additional monetary compensation for this role. ASHAs work under the supervision of *Auxiliary Nurse Midwives* (ANMs), who are more senior health workers and government employees who work at the village Sub-Center. They are responsible for a range of primary health services, with a special emphasis on basic maternal and child health [73]. ASHAs in Haryana are only need to have completed tenth grade, or even less depending on the availability of an eligible community member for the role. ANMs are required to complete a two-year diploma to be selected [73]. Alongside *Anganwadi workers* (AWWs)—health workers responsible for nutrition, family planning, and immunizations—ANMs and ASHAs form the grassroots women workforce delivering last mile healthcare in India. ASHAs, in particular, have played a key role in disease surveillance, information delivery, and vaccination mobilization during the COVID-10 pandemic.

3.2 Recruitment and Data Collection

Initial introductions to the ASHAs were made by a non-governmental organization (NGO) working on maternal and child health in Haryana, with whom two of the authors have a long-standing collaboration. The NGO partners with the National Health Mission of Haryana to work with 16,000 ASHAs in two regions of the state. They have more than thirty years of experience working on health, education, and community development services and research with women and children in North India. The authors have worked with the NGO on a number of research projects associated with training and community health education for more than five years. To recruit participants for this study, we started with the pool of ASHAs who had previously worked with Deepika and Pushpendra. Our participants' relationship with the NGO and previous interactions with the authors may have influenced their willingness to participate in the study and share sensitive information. We recruited additional health workers through snowball sampling, relying on our participants to introduce us to other health workers [38]. We conducted interviews remotely over WhatsApp and phone calls in two phases aligning with the first two waves of the pandemic in India. The first phase of interviews took place from November 2020 to December 2020, and the second phase from June 2021 to July 2021. Three health workers who indicated that they would be interested in having a follow-up conversation during the first phase were interviewed in both rounds, the rest were interviewed once. The interview protocol was designed in close conversation with the non-profit partner who made the initial introductions to health workers to ensure appropriateness and relevance of the questions being asked. The study was approved by the Institutional Review Boards (IRBs) at the Georgia Institute of Technology in the United States, and the Indraprastha Institute of Information Technology Delhi (IIIT-Delhi) in India.

At the start of our interviews, we took care to explain the purpose of the study to our participants in colloquial language, and address concerns around anonymity, as some of the data could be sensitive and incriminating if de-anonymized. Interviews ranged from twenty to sixty minutes. We asked questions on their workflows during the pandemic, fears and concerns, their use of technology for work, evolving digital literacies and digital access, and the potential for digital technology to support work. Though participants largely spoke of their own experiences, they were also able to shed light on the experiences of their colleagues at the Sub-Center. Interviews were conducted in Hindi by the first four authors and were audio recorded with consent.

3.3 Data Analysis

Each author transcribed and translated the interviews they conducted into English. These translations were reviewed collectively by all authors. We wrote memos alongside data collection to begin to abstract out themes emerging from the data [22]. This allowed us to also plan future interviews where we could delve deeper into these themes. We conducted interviews till we reached saturation in the data, across emergent themes. We then analyzed the data following the iterative inductive coding process outlined by Merriam [69]. Each author collecting data coded their own interviews. The codes were reviewed and aligned as a group to ensure consistency. The first round of coding was line-by-line and closely followed the transcripts, for instance, “mother hesitant to talk on phone,” “made errors while using app,” and “sending reports on Whatsapp.” We then grouped these to develop more high-level codes such as “technology breakdowns” and “online coordination with supervisors.” Finally, we arrived at broader themes such as “power differentials in coordination teams”, “care as a resource”, and “worker surveillance through data.”

3.4 Positionality

The first two and last two authors have extensive experience interacting with, and designing and/or developing technologies with and for frontline health workers in urban and rural India. Deepika and Pushpendra have previously worked with the NGO that we partnered with for the study. They have also spent significant time in Haryana, and are familiar with the context of the study. All authors are of Indian origin, some working/living in Sweden and the United States, and represent multiple religious and caste backgrounds. We acknowledge our relative class privilege as academics in relatively elite institutions, and are committed to using this privilege towards amplifying the concerns of FHWs. Our privilege is evident in our interview data, where participants routinely showed deference by referring to us as “*madam*.” This was possibly due to our association with the NGO, whose members they referred to as “*sir*” and “*madam*.” To be respectful to our participants, we used the honorific suffix “*ji*” with their names, which they frequently used with us as well.

4 FINDINGS

In the findings below, we first describe the top-down transition to technology-mediated workflows, including the use of mobile applications for data collection and reporting, coordination, and training. We then uncover the social infrastructures that defined how workers engaged in care work. Finally, we detail the labor politics surrounding these digital workflows. In each section, we point to the care demonstrated by various actors and the role of technology in mediating or hindering care.

4.1 Transition to Technologically-Mediated Workflows

We found that digital workflows of ASHAs were implemented in a top-down manner, frequently aligning with the interests of the government and supervisors. Below we outline the digital ecosystem that ASHAs were integrated into and the limited support they received in the process.

4.1.1 Technology-Driven Modernity by the State. Our interviews revealed that the state government through the National Health Mission (NHM) had made significant investments in digital technology for frontline health work in Haryana. During our first phase of interviews, we found that our participants had been provided activated SIM cards with data plans by the state government so that they could access the internet for their work. NHM also introduced the ‘ASHA Sarvekshan’ and ‘ASHA Pay’ mobile applications for regulating their duties and incentives (task-based monetary remuneration) [39]. Our participants were initially expected to use their own phones to operate apps, but unequal digital access resulted in protests by the ASHA Workers’ Union of Haryana to

demand for smartphones. As a result of their efforts, by our second phase of interviews, all ASHAs had been provided Android phones (Samsung Galaxy M01) by the government.

ASHA Sarvekshan¹ was initially launched for conducting and uploading door-to-door surveys on COVID-19 symptoms. It was later expanded to include many other kinds of data that ASHAs were already collecting as part of their routine activities around community healthcare. ASHA Pay was used to log the work completed to claim incentives every month. Prior to the introduction of these apps, our participants collected data on paper using multiple registers or diaries, and filled paper-based vouchers to claim their incentives. The new apps introduced were mandated by local authorities. Though some digitally literate ASHAs preferred data collection online, others viewed online data work as an imposition:

“We will have to use these now that they have launched these apps. We have no choice but to do online data entry now. They just ask us to do this and that... we will somehow do it. We do as much as we can, we do not say no.”

—Sunita (ASHA, 47 years, 10th grade)

The remark above, “*we do not say no*”, reflects the power dynamic between who gets to decide what work is to be done and who does the work. The perception that there was “*no choice but do it*” emerged frequently in our interviews for different workflows. We also found that WhatsApp was used extensively by all the ASHAs we interviewed; as Preeti noted, “*all the work happens on WhatsApp*”. Some ASHAs were also starting to engage in video conferencing apps, such as Zoom, in place of in-person monthly meetings at their Primary Health Centre (PHC) or for additional training sessions. The extensive network of ASHAs was also leveraged to integrate other government health services. To increase COVID awareness and enable contact tracing among the citizens, some ASHAs received orders from their PHC to get residents to install the Aarogya Setu application on their phones [80]. Aarogya Setu was introduced by the central government in April 2020 to help with disease surveillance [80]. It requires constant access to Bluetooth and GPS data to determine whether an individual has been within six feet of a COVID-19-infected person, through scanning a database of known cases across India. Several journalists, scholars, and lawyers have highlighted the app’s implications around citizen surveillance and privacy violations [80]. Many ASHAs we interviewed were unclear on the purpose of and risks associated with Aarogya Setu and had not used it themselves, but instructed residents to download the app.

Our participants found themselves integrated into a digital ecosystem with multiple applications and digital workflows competing for their attention. Prior research has largely focused on a single intervention being implemented with health workers at a time. As more health applications enter this space, we need to consider how they might interfere with or strengthen other digital and offline workflows, and the agency that health workers have over navigating across them to meet contextual needs. We also found that the digitization in frontline health was tied to technology-driven modernity projects by the state, rather than being motivated to improve healthcare efficiencies [84]. Health workers were recruited to help support specific digital initiatives that aligned with government interests. They had little role to play in decision-making except through activism and were afforded little agency in these workflows, which were implemented top-down and were linked to supervision and payment structures. The introduction of applications like Aarogya Setu also points to some of the complex ways in which data injustice can circulate among various human and non-human actors. The ASHAs’ role in motivating residents to install the application has implications for data privacy and surveillance of workers and communities. We further discuss privacy concerns that emerged in other workflows in later sections.

¹ *Sarvekshan* is a Hindi word that translates to ‘survey’.

4.1.2 Power Differentials in Coordination Teams. CSCW research has extensively studied collaborative technologies in health settings, such as to support communication between caregivers and doctors, care teams for patients, and caregiving dyads (e.g., [17, 52, 72]). However, the notion of “collaboration” in care teams remains mostly untroubled. More recently, Bhat and Kumar have problematized doctor-patient collaborations as they take place in Global South settings [18], and Karusala et al. have highlighted how social hierarchies are replicated in the use of chat in hospital settings [57]. In the context we studied, phone calls and widely used messaging platforms like WhatsApp were leveraged for coordination on frontline health workflows between ASHAs, ASHA facilitators, ANMs or supervisors, and even police officers and other local authorities during the pandemic. Coordination was a significant aspect of frontline health work, with the volume of communication being perceived as overwhelming by ASHAs. Despite the shared goal of improving community care across actors, the power dynamic allowed ASHAs little agency in these interactions. For instance, Meena shared: *“We were disturbed a lot, here I put rice on the stove and there the phone rang with work from the police that we need to go (for contact tracing), leaving the housework midway.”* Meena’s statement on the involvement of police officers also reveals how healthcare was political, and the enforcement of their workflows literally through policing in online and offline spheres.

Our interviews revealed that ASHAs were being asked to use WhatsApp for work duties even before the pandemic, but its use significantly increased during the lockdown. The use of WhatsApp by our participants was multi-faceted—to communicate with seniors such as ANMs and ASHA facilitators as well to report their work. Majority of the ASHAs we interviewed were part of WhatsApp groups that were used to inform them about their duties, pass any information, or to ask senior health workers any questions. WhatsApp became a necessary source of during the lockdown for information exchange, as Manushi noted:

“We had to click and send pictures on WhatsApp even earlier, but it has increased now madam... We were able to manage with someone else’s smartphone earlier, but it has become a necessity to purchase a smartphone now. Smartphone has become a habit now, how do we manage without it? It is an important tool, our madam conveys every message through WhatsApp.”

—Manushi (ASHA, 37 years, 8th grade)

Despite the volume of calls and messages, WhatsApp was largely used for one-way communication of instructions and reporting back by ASHAs. It thus served to reinforce existing power differentials and increased the workload, rather than leading to collaborative workflows that could improve care experiences for community members. During the pandemic, ASHAs were expected to be available to receive phone calls at any time, in case of an emergency. Many ASHAs expressed their frustration about receiving calls at all times of the day, and even at night. We also found that some ASHAs did not regularly check WhatsApp, and their peers had to nudge them to check it in case of any important communication from the seniors on the WhatsApp groups. Some ASHAs were also using WhatsApp to report their survey work to the seniors and to track visits:

“We used to send the photos of the HBPNC (Home-based Neonatal Care and Post-Natal Care) we did in the village using the smartphones. They (ANMs) also asked us to send photos and information of any patient with TB, sugar, or BP on WhatsApp. Sometime we also have to send pictures of the house visits during the survey.”

—Juhi (ASHA facilitator, 42 years, 10th grade)

The messaging platforms being used were not designed for such coordination, and entailed sharing of sensitive health information. Prior work by Karusala et al. on the use of WhatsApp by nurses in India has highlighted the privacy concerns that come with the adoption of personal tools for work. Our research underscores these concerns. Before widespread digitization, data were

largely stored offline, in registers and notebooks at the ASHA's home, before being digitized at the Sub-center. ASHAs were not trained on how to manage sensitive information, which could result in privacy of community members being compromised in digital interactions. ASHAs also shared their phones with other family members, such as by their children to attend classes remotely.

4.1.3 Scaffolding for Digital Transition. Despite the government's focus on digitizing health workflows, majority of our participants reported receiving no formal training on the introduced mobile apps. Instead, they were informally briefed and asked to install them on their smartphones. Sunita recalled her experience,

“We did not receive any training madam, we were just given the link to download it. We downloaded it, and then sir came for two hours and told four or five ASHA workers about it (the app). He just told us like that... they just gave us the link, and we clicked on ‘OK’ and downloaded it.”

—Sunita (ASHA, 47 years, 10th grade)

Such informal briefing sessions not only demonstrate a lack of attention to the varying digital literacy levels of ASHAs, but reflect an assumption that digital workflows with the new apps would be similar to paper-based workflows. It was particularly hard for ASHAs who were relatively less literate to understand during such briefing sessions, as Kalpana highlighted, “*She (the coordinator) just explained at a high-level in English and said I have downloaded your survey... Now you only tell me, what is the benefit of this, the register work was much better.*” On the other hand, several ASHAs we interviewed who were more digitally-savvy found the apps easy to use. For instance, Saina had a computer diploma, which she attributed to her adeptness with mobile apps. Such ASHAs perceived digital data collection to be easier than written data collection and could even increase their awareness around pending work tasks:

“Experience has been very good. We are able to do the work that we used to do offline on phone and it is much easier. When we feed data into the app we get more awareness. In the app, we have to put in the data point by point.”

—Komal (ASHA, 37 years, 12th grade)

The mixed attitudes to the sudden digitization of work reflects the heterogeneity in digital literacies across ASHAs. These likely intersected with other aspects of their identity. Some ASHAs referred to less digitally adept ASHAs as “*kam padhi-likhi (less educated)*”. Extensive prior work has outlined the role of education, age, socio-economic status, and geographic location in impacting online engagements [15, 48, 68]. We see these differences among our participants as well (see Table 1), with education levels ranging from tenth grade to Bachelor's degrees, and age from 24 to 47 years. Despite varying digital literacies, almost all the ASHAs we interviewed expressed a strong desire to receive formal training on how to use these apps. Prior research on literacies among FHWs have largely focused on investigating how existing digital literacies impact uptake of digital health interventions [61], or on how technology can provide training on health literacies [122]. Despite extensive research in the field of Information and Communication Technologies and Development (ICTD) detailing the creative ways in which communities access technology (e.g., [31, 109]), digital literacies have largely been viewed as static, with researchers designing technologies for where users are at. Limited work has deeply examined how these literacies are shaped beyond the role of intermediaries [101], and the scaffolding needed to support uptake of digital interventions. More recently, Thakkar et al. have uncovered how vocational workers in India are unprepared for the automation of their work, and are excluded from current technological platforms for skilling and job-seeking, and FHWs face similar futures [113]. The next few sections highlight how digital and data literacies were key skills for health workers alongside health literacies, and the need to pay

careful attention to how training processes are designed and implemented. Emergent research by mobile health practitioners in India offers some direction in this regard [111].

4.1.4 Dealing with Technology Breakdowns. ASHAs encountered several technical challenges and design limitations while using different apps. For instance, the apps only worked online and several participants reported frequent server and network issues due to intermittent internet, preventing them from doing the data work in real-time. Strict deadlines for uploading data did not leave time for addressing such issues:

“Earlier Sarvekshan app was not working properly, finally when it worked it did not let me download the surveys. Yesterday the app stopped working after I completed 150 houses. There are a lot of issues. We usually do not have time during the day, now our entire schedule has been disturbed. Now, I will have to do my ASHA work with kids after dinner.”

—Kalpana (ASHA, 53 years, 10th grade)

In such scenarios, ASHAs were forced to contact their ANMs and healthcare officials regarding the technical issues, which was time consuming and impacted other work planned. To mitigate the impact of such unanticipated technology breakdowns, ASHAs continued to note down their survey data in their personal notebooks or registers. Kalpana went on to explain, “*Madam, there are issues with using the app. Sometimes the phone doesn’t work, so we have to write it on the paper. We can simultaneously note down in the registers while doing the survey... but the app does not work when we go on home visits.*” Some ASHAs also received instructions to continue recording data on paper due to lack of trust in technology among senior health workers and officials. This indicates that even though the digital transition was initiated top down and designed for supervision, it was not particularly effective in its intended purpose. Senior health workers and officials were not convinced of the usefulness of the applications.

Despite differences in digital literacies, we found that our participants were adept at identifying technology and design needs for supporting their workflows. They expressed dissatisfaction over the specifications of the smartphones provided to them by the government, pointing to the insufficient storage capacity and frequent screen freezes. Though some reported lack of support over maintenance of these devices in case of damage or other issues, one of the ASHAs we interviewed managed to get her broken smartphone replaced by the government. Several participants also noted certain features missing within the apps which could have been useful to them. For example, they pointed out specific issues with the delete and edit functionality in ASHA Sarvekshan, resulting in duplicate and inconsistent data. They were unable to edit submitted data within the app, and could not make changes to household members in case of any births or deaths. They also frequently faced issues working with ASHA Sarvekshan during house visits if the household did not have information regarding certain entry fields. In such cases, they relied on paper-based records:

“Some families did not have a family health ID, so the app did not show their data. We had no choice but to note down their record on paper.”

—Manushi (ASHA, 37 years, 8th grade)

We see that ASHAs faced several technical challenges and design limitations when using work apps. These were not a result of limited digital literacies, ASHAs were doing what they could to learn and adapt to new digital workflows. The design of the applications reflected gaps in the developers’ and policymakers’ understanding of workflows on-the-ground and digital infrastructures available. Such challenges may be amplified as the Indian government targets integration with national platforms such as Aadhaar. Prior research has uncovered how platformized governance in India is furthering marginalization of communities that are already on the margins [105, 108].

4.2 The Social Organization of Care

Feminist scholars like Glenn have detailed the gendered and racialized dimensions of social organization of care—the systematic ways in which care is allocated and how responsibility for caring labor is assigned [37]. Glenn exposes the diverse forms of coercion that induce women to assume responsibility for caregiving [37]. We found that ASHAs too were engaged in various forms of caring labor due to their perceived duties towards and societal expectations from their families and communities. We detail the care labor that they were engaged online and offline due to the social responsibility they assumed, and the various conflicting care demands placed on them in their social relationships. We also find new forms of social organization that emerged among ASHAs, leveraging care as a resource to build community networks for support with digital transition.

4.2.1 Building Caring Relationships with Communities. During the first two months of lockdown, many ASHAs were instructed by PHCs to cut down or pause their home visits for routine maternal and child care, and to take additional precautions. Many ASHAs tried to perform their duties with community members via phone calls or over WhatsApp to enable continuity of care. Preeti recalled her experience doing routine checkups with pregnant women and new mothers:

“During the first two months of strict lockdown, we tried to do our key activities, that is home visits for pregnant and new mothers, through phone calls. We asked women about their health through phone calls. These were not really inquiries but asking about only a few basic things, for example—is your child okay, is your baby taking proper feed? In case any serious problem would have arise then I would have helped the women to go to hospital but I did not receive any such case.”

—Preeti (ASHA, 27 years, 12th grade)

Our interviews revealed that conducting such activities over phone calls had several limitations. ASHAs could not perform certain health tasks such as weighing the baby, and physically observing the mother and the baby. Most of the ASHAs we interviewed strongly preferred in-person visits due to the nature of their work despite the pandemic. Anita described how face-to-face interactions facilitated better conversations with community members and were crucial for relationship-building:

“Madam, we cannot do our home visits using our phone. There is a difference in talking on phone and face-to-face. You can just talk to one person on the phone, but you get to meet their whole family if you visit their home. Often, daughter-in-laws feel uncomfortable in saying things on the phone in the presence of their mother-in-laws, but home visits can facilitate our conversations with both.”

—Anita (ASHA facilitator, 44 years, B.A.)

Our findings in earlier sections reflected limited data literacies, but ASHAs were sensitive to and adept at navigating privacy concerns in offline settings. They made an effort to not only preserve privacy, but also address taboos that made conversations difficult with other family members. This work was not expected by their supervisors, but something they felt obliged to do to maintain community relationships. Private conversations could not always be conducted on the phone, even on chat, as these devices were typically shared with other family members. Protecting privacy in a digital setting in this context could thus sometimes mean avoiding certain interactions online. Some ASHAs also shared that many women in their area did not have phones which meant that they had to conduct home visits. Given these concerns, future telehealth services with ASHAs and mothers may be more effective for information dissemination and support with less sensitive health topics and less critical care needs, and in homes that have better digital access.

As the lockdown eased, home visits slowly resumed with added precautions and continued remote interactions. A few ASHAs, however, reported being denied to weigh or touch the newborns

by the family members due to safety concerns. Sushma shared, “*We used to go anyway, by wearing mask, sanitizer. Some educated families would say—don’t touch our baby, we will file a complaint. So, we used to say that we will see your baby, just seeing a baby is also enough to know if the baby is healthy or not... We used to do it because not doing HBPNC is going to affect us, the community expects that from us. People will say—that ASHA does not come.*” Sushma’s comment reveals the societal expectations that health workers had to manage. The mention of “educated families” also reveals the role of class differentials. Such households may have been more informed and cautious of the pandemic and chose to exercise their agency in health interactions, such as by threatening to file a complaint. On one hand, this indicates the potential for more community-driven health and digital infrastructures (as these households were likely receiving information through digital means). On the other hand, it reflects the limited power and authority that ASHAs may have in certain homes. We need to be cautious about the knowledges and expertise that may come into conflict as such health workers’ relationships with communities continue to evolve, and consider the role that ASHAs’ may have to play as trusted (and mistrusted) sources of information.

4.2.2 Conflict between Perceived Duties and Safety Concerns. The COVID tasks were undertaken by ASHAs amidst significant safety concerns. All our participants expressed fear of getting infected during the multiple rounds of COVID surveys and regular field visits. Several of them had young children and their fear extended to their family’s safety as well. They found themselves grappling with perceived duties towards their communities and the healthcare system, and their concerns over their own and their families’ safety. These concerns also overlapped with conflicting care demands as ASHAs also managed care demands at home, due to gendered roles and the perceived voluntary nature of their ASHA work. Juhi recalled her fear of getting infected:

“Family comes first ji, everything else is second. My relatives used to say that you roam in everyone’s house, if you get infected then we will also get infected... This is how corona disease is. We do not have that much money. If I had been infected, how would I have spent that much money on the treatment? I would have had to spend much more than my earnings.”

—Juhi (ASHA facilitator, 42 years, 10th grade)

Despite the pandemic and the high-risk tasks ASHAs were involved in, they were provided with limited protective equipment, and were not assured of any medical support in case they got infected. Many of our participants had not received PPE kits, masks, gloves, or sanitizer at the time the interviews were conducted, and had to purchase their own. For instance, Juhi received only “*half bottles*” of sanitizer. Preeti shared, “*We used to purchase our own sanitizer... we did not receive anything from the government. The seniors told us to either purchase the masks ourselves, or make the cloth masks at home.*” Amidst these safety-related concerns, the notion of duty was a powerful motivating factor in continuing the work. For instance, Preeti was pregnant when the lockdown was announced and was scared of conducting surveys. People in her area told her that she should not get out of the house at this time but she continued because “*This is our duty so we have to do it.*” For some of our participants, however, the high workload of pandemic tasks for low pay and at high risk reinforced a sense that their lives and work did not have much value. Mamta passionately expressed her views saying, “*We are doing the work but give us some safety! Who is responsible (if something happens)?*”

ASHAs thus continued to work in exploitative and unsafe conditions due to the highly gendered and socialized perception of their *duty* to care. Glenn details how women are frequently underpaid/unpaid for such work due to perceived social and moral responsibility to their families and communities [37]. Prior research has highlighted ASHAs’ discontent with the government on the exploitation of their labor and lack of benefits such as pension and medical insurance [47].

Technological investments made by the government amidst chronic under-investment in other areas calls for reflection on how resources for care work are allocated for maximizing impact. Further, the reliance on women's labor, without adequate compensation or respect for that labor, has troubling implications as ASHAs' work is digitized.

4.2.3 Persisting in Care Work. Witnessing the ASHAs work with risk to personal safety led to increasing recognition of their work in some communities. Sunita related that, “*respect has increased during corona, people listen to us and we listen to them.*” However, there were also many conflicts driven by fears of getting COVID, lack of trust in ASHAs, or misinformation around COVID. Despite having painstakingly developed good relationships with households over the years, ASHAs shared that community members frequently complained about repeated visits for surveys to help with contact tracing. One community member told an ASHA that, “*you come here and spread corona.*” Several ASHAs also reported that families were skeptical whether their home visits to conduct COVID surveys were useful, showing lack of cooperation and sometimes resistance, partly because of fear of the quarantine process. Yet, ASHAs persisted in their home visits to provide care:

“When we used to visit houses for corona survey, people were fearful of being taken for isolation to hospitals—what if the ASHA tells and they send someone. This fear created problem for ASHAs. I had to explain to families that it is our duty to report the data, we are not filing any false registration for Corona positive for you, don't be afraid, you will get free medication. Saying this gave me the data.”

—Preeti (ASHA, 27 years, 12th grade)

Though Preeti reassured community members so that she could get her job done, she had to follow protocol for quarantine if the community member tested positive. The fears of community members were not entirely unfounded. Several media reports have described the difficult experiences of people forced to quarantine [16]. Some ASHAs reported altercations with the residents as a result of the quarantine process:

“Two came to my house and fought. One said that if something happens to my mother, I will drag you. So I didn't say anything, I called the male worker (Male Multipurpose Workers who are present in some Sub-Centers) that sir, these people have come to fight. So I got him to talk to them on the phone. Then sir berated them saying—just because you (the community member) are a doctor, so what, what is the meaning of going to the ASHA's house to fight?”

—Sushma (ASHA, 35 years, 12th grade)

ASHAs expressed their helplessness in such situations when they were simply “*doing what we've been told to do,*” yet were the ones facing conflict and blame. To address such situations, they relied on other stakeholders with more power and respect in the community to lend credibility, due to their social position or gender. For social support, they also sometimes traveled in groups with other ASHAs or local actors, such as police officers. However, the engagement of police officers for community compliance points to the danger of eroding democratic rights during healthcare crises. When COVID vaccination drives opened up to all citizens of India in April 2021, ASHAs were also instructed to motivate people in their communities to get vaccinated. However, some participants reported facing significant challenges and conflict due to prevalent vaccine hesitancy and misinformation. In one such case, the ASHAs working in the area were Hindu but working in a predominantly Muslim area. Rising communal tensions in India and lack of trust in the ASHAs may have contributed to vaccine hesitancy:

“I went from house to house, motivating people to get vaccinated. Some were ready to get vaccinated, some would even call again and again to ask. But, in the Muslim area,

majority of the people don't believe us. They say that you are giving us fake medicine. They don't understand ma'am... Some said we will die after a few days, while some say you are giving us a fake vaccine. A few others even accuse us saying that we gave real vaccines to our staff, but are providing fake vaccines to the villagers. Even now there are some families that don't want to understand, even now they don't want to get the vaccine."

—Manushi (ASHA, 37 years, 8th grade)

Such interactions reflect the highly politicized nature of healthcare which could not be addressed by ASHAs alone. In such cases, they would call and request their ANMs to lend the credibility and convince the community member. ASHAs thus faced significant challenges working with communities in the pandemic, amidst misinformation and vaccine hesitancy. Their efforts to address misinformation, resolve conflicts, and motivate community members frequently went unseen and unacknowledged. We also see how communities exercised their agency to protect themselves and their families from a flawed healthcare system, and political entities that may have hurt them in the past. Despite conflicts with community members, ASHAs continued to persist in their care work. To some extent, their approach aligns with the logic of care as described by Annemarie Mol, focusing on community needs rather than prioritizing patient choice, when the latter could be to their detriment [75]. However, ASHAs could also be too dismissive of community fears, which were rooted in experiences with public discourse on politics, and their own and others' past experiences navigating the healthcare system. These interactions overlapped with digital data collection, and involved the use of phone-based coordination to apply pressure on communities.

4.2.4 Care as a Resource. To address the lack of government support during the digital transition, our participants developed local community networks to support each other. This included groups of ASHAs and ASHA facilitators, their family members, and even ANMs. There was a strong sense of solidarity across ASHAs, even among those who were digitally literate:

"It must have been very difficult for the less educated ASHAs. We did not face as many problems because we learned a few things from our children, and then learned a few other things by using it while sitting with our friends. How would they have managed?"

—Kalpana (ASHA, 53 years, 10th grade)

Kalpana's experience reflects the role of family and friends in helping navigate digital workflows. We also found that some ASHAs were dependent and consistently sought assistance of their family members, especially their school-going children for performing their online duties like uploading survey data on the apps. This aligns with prior studies on the role of intermediaries in mediating phone usage among those with limited literacy levels [101]. During the initial few months of the launch, several ASHAs also relied on their ANMs and ASHA facilitators for online data entry tasks, as they did not know how to use these apps:

"It has been seven or eight months, we have learned it now. Our madam used to do it earlier for us. Our common facilitator did it for the first two or three months if we faced any difficulties or when we could not. We have started understanding it... we can do it ourselves now."

—Manushi (ASHA, 37 years, 8th grade)

The support of ASHA facilitators went beyond training, with some of them actually recording the data for the ASHAs in their area so that they could get paid. We also found peer learning among ASHAs to learn to use the apps. ASHAs formed community networks to learn amongst themselves, where more literate ASHAs explained the online data entry process to their peers. An ASHA facilitator (Komal) shared, "*We created groups to learn together. Even now we do that.*"

A few days ago I helped ASHAs at the subcenter to fill the data.” Prior research has highlighted expressions of solidarity among ASHAs and the need for solidarity with other healthcare actors as well [47]. Similar networks were also visible in other areas. For instance, ASHAs were also using video conferencing apps such as Zoom to attend online meetings. However, due to a cap on the number of people who could join a meeting, not all ASHAs were able to join the meetings from their phones. To address this challenge, they came up with workarounds by meeting in small groups in-person and sharing a phone:

“Ma’am, the problem with Zoom is that it does not work if a thousand members have joined the meeting. The ASHA could not attend the meeting sitting at her home. So, all the Anganwadi workers, teachers, ASHAs used to sit together and attend the meeting. If someone is able to join the meeting using the meeting ID, then rest all used to sit around that person.”

—Manushi (ASHA, 37 years, 8th grade)

Manushi’s comment also reveals how online meetings also enabled workers across programs to assemble in a shared virtual space, which rarely occurred before the pandemic. We see how care served as resource, mobilized through community networks of peer ASHAs, seniors, and family members, in the absence of formal government support for digital transition. Such efforts emerged as a necessity so that ASHAs could continue to perform their work and get paid. Prior CSCW research has demonstrated how care can serve as an asset in such settings that may be resource-constrained in terms of material infrastructure [56].

4.3 Labor Politics Surrounding Digital Workflows

Much of the labor that ASHAs were engaged in were poorly compensated, and digital workflows further increased their workload and enabled worker surveillance. Many ASHAs organized strikes and protests as part of the ASHA Workers’ Union to surface these issues. Below we detail the labor politics in this context and technology’s complicity in perpetuating harm.

4.3.1 Redundant Workflows and Persistence of Paper. The high workload due to digital workflows was repeatedly brought up by our participants. The various digital applications being implemented introduced several redundancies in their work. Prior HCI research has documented the persistence of paper in global development organizations and e-governance initiatives [27, 64]. Mamta shared her frustration on the many redundancies and preferred the use of a single application:

“Phone has made our work easy, we can sit comfortably and do it. But the government has doubled our work. We can’t just do the work on the phone, but have to do work on the register and on the phone. We demand that written work be removed. We can do it on the phone easily... There are so many different types of surveys that we have to do. We had to download three or four apps. At least give us only one thing to do.”

—Mamta (ASHA facilitator, 42 years, 10th grade)

Not only were there redundancies between paper and digital workflows, but also across multiple surveys, and across apps. Though Mamta preferred using a phone, other ASHAs shared an important difference between paper and online data formats. Through paper registers, they had developed ways to index data which helped them quickly respond to different data collection requirements:

“Sometimes they ask count for ten to nineteen year old children, sometimes for five to ten year old. For the data asked for the May month, I will have to explain to ASHAs to go back five years from this May, and then count number of kids from May to May. We have asked ASHAs to maintain a register of up to nineteen year old children starting since 2000 and keep on adding counts in that. So whenever we are going to be asked

for any type of data record, we don't need to go over ten registers.”

—Pooja (ASHA facilitator, 48 years, 12th grade)

We also found that some redundant workflows that ASHAs engaged in were motivated by concerns around the credibility of their work when presented to seniors. For some of our participants, paper-based data entry also acted as a more credible source of work for the community and supervisors and officials, in case of technology breakdowns. Unlike digital data collection, paper could serve as a shared record that is visible and legible to all relevant stakeholders:

“If everything shifts online, then people will chase us asking to get death certificate since we filled their online form. We prefer paper mode because then we do it in front of the family, ask them to check it, and then punch the form. We submit the form after getting it signed from others such as ANM, Anganwadi worker, and the sarpanch then sign this form, and then the families receive the death certificate.”

—Priya (ASHA, 26 years, B.Ed.)

We see that ASHAs were recruited to perform many different kinds of work and managed a high workload during the pandemic. Though digital applications for data collection could make certain tasks easier for some ASHAs, they also led to redundancies when introduced without adequate alignment with existing workflows, resulting in an overall increase in workload. The digital medium also lacked the ease in indexing and credibility of paper, and did not fully replace paper-based workflows.

4.3.2 Data Needs or Worker Surveillance? Our interviews revealed that data reporting was perceived by many ASHAs as a tool for management and worker surveillance rather than for improving workflows. One ASHA facilitator (Mamta) expressed her frustration with extensive reporting and supervision and how it could be infantilizing, “... *I had to check the work of the ASHAs under me as well. There was so much checking, like checking an exam paper of a child.*” Pooja shared the extent of reporting required by various senior workers:

“We don't know, they can ask for any kind of data at any time. ANM asks for data in a different way, coordinator asks in some other way. Consider the COVID survey only, coordinator was asking us—how many COVID patients did you see today, how many were sick, how many had breathing problems, how many had BP problem, etc. ANM instead directly asks how many households did you cover. They spin around the same data in different ways.”

—Pooja (ASHA facilitator, 48 years, 12th grade)

We found that there were limits to the level of supervision that ASHAs were comfortable with. One particular app (MDM Shield 360) launched by the government in 2021 led to fear of surveillance among ASHAs and widespread protests [20]. An ASHA facilitator who was concerned about the potential surveillance described the purpose of the app thus:

“If an ASHA worker uses internet too much, that information will now be made available to the block coordinator. If our supervisor wants, she can restrict access to any mobile app like YouTube, Facebook, etc. Our phone will only run those apps that our supervisor wants us to use.”

—Mamta (ASHA facilitator, 42 years, 10th grade)

Such surveillance of phone usage is not only highly invasive and leaves workers vulnerable to exploitation, but also denies workers of agency and ownership over their time and the technologies they are provided. Prior usage of technology for tracking workers by government bodies, such as of sanitation workers by municipal corporations in Haryana, has resulted in salary deductions and high physical and mental stress among workers [60]. Further, the investment in the development

of such technology also raises questions about how allocation of funds is determined. However, we also found that concerns around surveillance was not universal. For instance, Komal shared:

“For the MDM app, I don’t have too much knowledge but some ASHAs were raising concerns about it. Some wrong information was going around that the app is tracking. They did not want the app to do that. My own opinion is that even if the app is tracking, let it track. We are doing the work. We will be a little under control then. But some ASHAs did not want tracking.”

—Komal (ASHA, 37 years, 12th grade)

Extensive literature has detailed the culture- and context-dependence, uncertainty, and malleability of privacy behaviors [2, 100], and the need for technologies to be privacy-preserving by design. The quote above reveals differing attitudes to privacy and varying data literacies among ASHAs. It also points to differences in how information was distributed and shared across workers, the potential for misinformation, and lack of trust in information received. Sultana and Fussell have documented how misinformation spread in rural Bangladesh during the COVID-19 pandemic [112]. Such spread is particularly concerning among community influencers like ASHAs, who are responsible for information dissemination in their communities.

4.3.3 Financially Precarious Nature of Care Work. All the ASHAs we interviewed reported that they had to perform extra duties related to COVID as soon as the first lockdown was announced in March 2020. They were compensated INR 1000 (approximately USD 13.50) per month for this work, according to the policy of the national government. ASHAs offer a massive platform for outreach, quite unlike any other human infrastructure at the state and national level in India. Leveraging this network of ASHAs for increasing healthcare and data collection tasks suggests a troubling trend of relying on women workers for cheap labor without investing in more sustainable infrastructure. The added workload also reflects a broader trend of integrating ASHAs into various government programs including digital workflows:

“When we joined we were told that you just have to tell when there is a birth in the area, we have to tell when there is a death in the area. Now our situation has been made so bad. According to me, this is how it should be—we do the ANC (Antenatal Care) of women, the delivery and care of children, that’s it.”

—Meena (ASHA, 39 years, 10th grade)

ASHAs also expressed discontent over having to spend from their own pockets for various logistical costs such as hiring vehicles while taking pregnant women to hospitals, issuing vaccination cards for mothers, buying thermometers, and more. Several ASHAs called for fair compensation based on the workload:

“See, if they fix the payment package then everyone is ready to do the work. With 4000-5000 (rupees), the burden is very high—we make rounds in the village, take reports and then submit on the phone.”

—Pooja (ASHA facilitator, 48 years, 12th grade)

The use of ASHA Pay brought additional concerns around remuneration. One ASHA explained that a lot of concentration was required while logging their work within each field in the app. Several participants expressed fear of making mistakes while using the app as their incentives were now linked to data entered. Babita stated, “*ASHA Pay should be closed. Those who are 12th pass cannot even operate it.*” Several others reported delayed payments and pay cuts due to data entry errors. They desired more transparency and control in apps such as ASHA Pay to understand how their incentives were calculated:

“Madam, we should also have the option in our phone to check the payment received month-wise. The app has no details about who we received the money from, the amount, and when we received it. Shouldn’t all of this be there as well?... If you are asking us to use phone for our work, then we should have details about our money in it as well.”

—Sunita (ASHA, 47 years, 10th grade)

We see that digitization and datafication made some work visible while rendering others invisible. Only work that was counted, measured, or tracked was visible and compensated [70], leaving health workers vulnerable to exploitation. Technologies like ASHA Pay were developed to track work on a regular basis, but offered transparency and control only to the supervisors. On the other hand, the funds spent by ASHAs in their everyday work were not tracked, and the process of reporting to receive reimbursements was too burdensome for ASHAs to bother with it. The additional work of dealing with technology breakdowns, redundant workflows, and community conflicts also remained invisible. Online and remote work and many pandemic activities were unpaid or had a nominal compensation. One way to address the power differential could be to offer visibility to ASHAs on how their salaries are calculated and dispersed.

4.3.4 Labor Organizing for Advocacy. Our interviews revealed that ASHAs’ interactions with various healthcare actors, poor pay, and lack of support left them feeling devalued. Conflicts with ANMs and frustration with the healthcare system overall was a consistent theme across interviews. Kalpana shared her perception of the treatment they received from staff at the PHC and Sub-Center:

“We do all the ground level work, yet we are not valued. I don’t want to speak but I felt very sad when LHV (Lady Health Visitor, who are senior ANMs) said this thing—why does an ASHA need a chair, ASHA will either stand or sit on the floor.”

—Kalpana (ASHA, 53 years, 10th grade)

Such comments reinforced the perception that ASHAs lacked value, not enough to even justify having a chair during meetings. In light of such issues, many ASHAs joined the ASHA Workers’ Union of Haryana. They frequently organized strikes and protests to advocate for better working conditions. For instance, in December 2021, thousands of ASHAs surrounded the home of Haryana’s Health Minister to demand that the additional INR 1000 (approximately USD 13.50) monthly incentive for COVID duties be reinstated (it had been discontinued in October 2021) [23]. Technology also played a key role in helping organize these initiatives. For instance, our interviews revealed that getting access to smartphones was a significant undertaking by the union. The government announced that the workers would receive phones initially in 2018, but they were finally provided in 2021 after strikes and repeated demands by the union [45]:

“We got a phone around a month back from the government, before that they had given SIM cards with data plans. That also we got because of the union, we fought a lot and got it, otherwise they were not giving. Before that I was using my own smartphone.”

—Preeti (ASHA, 27 years, 12th grade)

Preeti revealed that the push for phones by the union was to address the differences in digital access across ASHAs as many could not afford a smartphone, and to also help keep work and life separate. The phones were provided at a time when the pandemic was well underway, and the use of several mobile applications that required a smartphone had already been mandated by the government several months before.

Technology played an important role in such organizing efforts. Though WhatsApp served as a tool for governance and coordination by healthcare authorities [30], it also made it possible for workers to quickly organize and share concerns. In one case, we found that a screenshot of an email from the state coordinator for the National Health Mission in Haryana was being circulated

among ASHAs on WhatsApp. The email claimed that the MDM Shield 360 app was not being used for surveillance and requested that a strike organized by the union be called off. However, media reports have documented how the union's own investigation into the app surfaced surveillance concerns [20]. Lack of trust in the government due to past experiences may have also contributed to the strike continuing to take place despite the warning by the state coordinator. The strike did result in the app being finally being recalled, and demonstrates the power of collective action by ASHAs. Despite such smaller wins, financial demands remained unmet, though other health workers had fixed and regular salaries:

“We went on strike for one year, and what did we get, 4000 rupees and the Anganwadi worker didn't do anything, just went eight days and got 12,000 rupees. It's been one whole year and she is sitting at home and even now she is sitting at home. Their salary comes to their account every month and ours comes after two to three months.”

—Kalpana (ASHA, 53 years, 10th grade)

Labor organizing, however, could have severe negative consequences. An incident narrated by Babita illustrates the financially precarious nature of ASHA work, and the silencing of worker activism by government actors:

“Anjali (name changed) at our center used organize strikes. One day, there was checking at our center. . . We had been told not to do as much written work by our ma'am (ANM), but we were doing all visits. In January 2021, a team came down from Panchkula (a town in Haryana). They checked our work but didn't see any written work. Our senior knew what happened but didn't say anything. . . They cut 11,000 rupees from each of our salaries, for six of the ASHAs at our center. . . We're doing this work during a pandemic, but see what they did to our team. They should have asked the reason. You can cut for specific tasks, but what is this you did to us?”

—Babita (ASHA facilitator, 44 years, B.A.)

Babita perceived the checking as a power move or “*revenge*” by officials in response to the strike. Not only was the salary cut considerable for the ASHAs, it highlighted that their salaries were not secure even if the work had been completed. Without data as proof of their work, they could be penalized at any time. The ANM whose instructions were being followed also did not express solidarity with the ASHAs, likely due to power differentials with the officials.

5 TOWARDS CARING FUTURE(S) OF FRONTLINE HEALTH WORK

Our findings detail how care work and the use of technology to support care work are embedded in the social, political, and economic context. FHWs frequently found themselves unsupported by the state as they labored to care for their communities. Even as their care labor was exploited, however, FHWs leveraged care as a non-material resource or asset to support themselves and their communities [56]. We offer the language of *care orientations* to provide a starting point to understand FHWs' actions, the contradictory stances that they embodied at times, and the various conflicts that emerged across actors. We take inspiration from feminist scholar, Sara Ahmed, who eloquently argues that “*orientations matter*” [3] and that “*To be oriented in a certain way is how certain things come to be significant, come to be objects for me*” [3]. We identify four intertwined ways in which FHWs attempted to build more caring futures for themselves and their communities, by focusing on or orienting themselves towards:

- *survival* (by working within the system) to maintain their livelihoods, and ensure that their families, and communities were safe and insured against harm and illness,
- *resilience* (by working outside, but still with, the system) to create and maintain community resources that could provide support when experiencing adversity,

- *advocacy* (by working to change the system) by raising voice against oppressive structures, for themselves or others, and
- *resistance* (by working against the system) to dismantle or replace oppressive structures.

FHWs engaged in one or more of these based on their overlapping social identities and personal experiences with the healthcare system and communities. These various approaches to care did not exist in isolation, *multiple were visible at the same time*. Exploring a particular orientation could lead us to others, and we embrace and invite researchers to explore these interdependencies. For instance, building resilience could help with survival in the long-term. Resistance could entail advocacy, among other forms of action. Various orientations or approaches to care could also come into conflict, such as when resistance could impact survival through loss of livelihoods if the state choose to retaliate. We suggest these also as care orientations that researchers can take to build improved futures for care work when engaging in technology design. This can help identify what objects to be oriented towards and pathways to care in a given context. Each of the orientations we identified may bring researchers into conflict with oppressive structures to varying degrees. One can (and likely must) engage in multiple orientations though they could come into conflict, at different points in time or even at the same time in a given context. Future CSCW research on care work could further expand on and problematize *orientations*, and offer potentially new objects for researchers and designers to be oriented towards. Below we discuss the futures that the care orientations that we identified might lead us towards.

5.1 Care for Survival

For many FHWs that we interacted with, simply surviving everyday work *within the healthcare system* was a priority, in an attempt to care for themselves and their families. Several FHWs were also exhausted from seeing the limited gains in salaries and benefits and retaliation (e.g., pay cuts) as a result of their activism. They did not have energy to expend beyond focusing on survival. Though safety from COVID-19 for them and their families was a key aspect of this, they also placed high value on community safety and undertook in-person visits with caution, leveraging tools for remote communication where appropriate. FHWs also attempted to protect their livelihoods by adapting to the transition to digital workflows to keep themselves employable. Researchers can choose to align with these efforts by FHWs while working within the system. For instance, many FHWs expressed the desire to be better equipped for digital transformation, through regular training on apps being introduced. Such training could be delivered offline or in-person, while taking into account the varying education levels and technology experiences of FHWs. It could include support on handling technology breakdowns and strategies to offer effective care remotely. Given that FHWs were increasingly meeting online on Zoom and other platforms, virtual training and meetings could become a long-term option for FHWs who have to travel long distances and pay for transportation out-of-pocket. Such efforts to build digital skills could also help them become more employable if they wish to find alternative or secondary sources of income.

Survival could also take more everyday forms, such as managing digital transitions effectively to ensure that FHWs were paid for their work. Researchers could also support workers on this front. With the proliferation of apps, FHWs found themselves having to learn to switch between online and offline, and across online workflows, while experiencing infrastructural gaps like intermittent internet, technical and design limitations, workflow misalignment, and more. Vertesi's analytical vocabulary of *seams* offers a useful construct to think about "*such multiple, coexisting, nonconforming infrastructures which actors engage at the same time*" [119]. Prior research on digital state programs for food distribution and telemedicine in India have detailed how human actors learned to artfully navigate across seams [21, 108]. We encourage researchers and practitioners to work with FHWs to

find ways to work creatively across these seams, such as by helping plan workflows to anticipate seams. A focus on supporting FHWs within the system could also entail addressing design and technical gaps of existing mobile applications to make digital integration seamless, such as by supporting offline data entry and providing key data fields. However, we caution researchers on the limits of a care orientation towards survival without critical reflection. There is a risk of technologies designed being co-opted by the state to perpetuate harm. For instance, apps for communication and data collection were already increasing the workload on FHWs and making technology more seamless could result in more data work going digital.

5.2 Care for Resilience

Beyond everyday survival within the system, FHWs found ways to support each other in the absence of government support, through community networks *working outside or at the peripheries of the healthcare system*. FHWs created community networks with their peers, family members, and even ANMs to help with training on the new apps. Vyas and Dillahunt have outlined how resilience is a social and care-focused process [120], as we observe in this case as well. Similar community networks have been studied in other countries, such as emergent mutual aid networks among gig workers in Jakarta during the pandemic [94]. Karusala et al. have also previously studied resilient practices among FHWs dealing with missed and delayed digital payments [54]. Care in such community networks could help digital and health workflows in the long-term by keeping FHWs motivated, helping find collective solutions to technology breakdowns, and filling infrastructure gaps, such as through peer learning to address information gaps. Researchers focused on supporting these resilient efforts could help design technologies to strengthen community networks. Prior IVR and mobile platforms developed by HCI researchers for peer-to-peer learning could be leveraged here [122, 125]. We caution, however, that the existing community networks were driven by necessity and shifted the burden of addressing gaps to FHWs.

To avoid burnout in the long-term, responsibilities could be shared with community members and senior health workers and officials, through additional networks (maintaining existing networks as safe spaces for FHWs). Our findings revealed that some community members did not cooperate with FHWs for contact tracing, quarantine procedures, and vaccination mobilization. However, they were more willing to cooperate with senior health workers or officials. Online communities with FHWs and officials could engage community members to increase transparency, legitimize the role of FHWs, reduce redundant information flows, and lead to more cooperation overall. Communities could report emergent symptoms, share suggestions for improving the healthcare system, clarify health information, and motivate uptake of healthy behaviors. Prior community interventions in the fields of health informatics and civic engagement could be adapted here (e.g., [12, 46, 81]).

The strain that the COVID-19 pandemic placed on health workers also highlights the need for the healthcare system to be more resilient to future pandemics. The World Health Organization (WHO) and leading health institutions have predicted that extensive ecological destruction has increased the likelihood of future pandemics and epidemics [43, 65]. A wealth of HCI literature in the field of crisis informatics could inform technology design for healthcare crises. Online channels for distributing resources, managing health information delivery, and formulating contingency plans could prove helpful [25, 110, 121]. However, even with effective channels for crisis response, gaps are likely to persist due to resource constraints and potential infrastructural breakdowns. Resilient community networks could help resolve such challenges as they arise [121].

5.3 Care for Advocacy

FHWs also labored towards *more systemic change* by advocating for their interests. Many FHWs joined the union to increase their visibility and power as a collective. We found that the workers'

union was effective in surfacing the concerns of FHWs, and even achieving government action, such as the provision of smartphones and recall of the surveillance app in Haryana. However, more sustained change remained elusive. Though FHWs had been advocating for fairer wages and benefits as government employees for years, they had been unable to get a fixed salary from the government and continued to operate on a piecework basis. Researchers could lend their relative power to FHWs' advocacy efforts, and also engage their voices in technology design. One potentially sustainable approach could be to engage the leadership and members of the union in the participatory design and implementation of technology, while compensating them fairly for this work and knowledge. Our findings indicated that the union was supportive of mobile technology, but also sensitive to privacy concerns and differences in digital access and literacies across FHWs. Technology could also help amplify the voices of FHWs by creating redressal mechanisms in case of conflicts with officers, to improve accountability across the board. However, the effectiveness of such technology depends on existing institutional intent to address issues [115].

FHWs also called for more respect for their time and labor by other healthcare actors. Remote communication led to work demands at all times of the day and poor separation of work and family life, which could be addressed through fixed work hours and systems for triaging tasks. Digital technology could help create work schedules, and assign tasks well in advance of when they are due. Greater respect for the time of FHWs' also entails reducing redundant workflows to make more time for care work. One source of redundancy was the high reporting needs and lack of credibility of digital records, which could be significantly streamlined across stakeholders. An alternative to tracking short-term outputs that also reflects greater respect for the knowledge and capabilities of FHWs could be to track the development of their skills, community satisfaction, and health outcomes over time. For FHWs who preferred the digital medium, robust and reliable apps should aim to fully replace an existing paper-based or in-person workflow. Technology design should also allow for worker control, empowering FHWs to make informed decisions on what tools work best for them and their communities. FHWs identified a need for more transparency and control when using technology, for instance, when dealing with monthly incentives. This involves the ability to see how the incentives are calculated, and edit and delete data if needed. Prior work by DeRenzi et al. offers an exemplar in this regard [28, 29].

We also acknowledge and highlight that technology cannot substitute for poor labor policies. FHWs lacked financial security and access to basic safety equipment, and were also concerned about surveillance. As in the case of gig or platform work, which has been extensively studied by HCI researchers [5, 93, 99, 103], the work of FHWs was viewed as flexible and voluntary by the government, despite being a full-time job in practice. FHWs did not have access to reliable health insurance, though life insurance had been provided under a government policy during the pandemic [79]. Government policy and budgets should align with essential needs at the frontlines, such as the safety of workers and distribution of basic protective equipment, over investments in technology. Researchers may be well-placed to advocate for such policies, and prior CSCW work has detailed how we might undertake such activism [4, 51]. Without policy changes, digitization will continue to perpetuate existing workflow issues, and serve as a poor fix for an underpaid and tired care workforce.

5.4 Care for Resistance

In addition to raising their perspectives within the healthcare system, FHWs also *actively worked against the system*, such as by resisting digital efforts that they did not align with. For instance, in the case of the MDM Shield 360 mobile app for worker surveillance, FHWs refused to use the app and documented their concerns, organized strikes and protests, and talked to journalists. Their collective action resulted in the app being recalled. Researchers and practitioners can align with

this orientation by refusing to build and actively resisting alongside FHWs against the development of technologies that increase their workload and enable surveillance [104]. The feminist data manifest-no takes this approach, through the refusal of harmful data regimes and commitment to new data futures [24, 36]. Our study uncovered that the state had invested significant resources into technology integration in frontline health. The launch of the National Health ID in September 2021, which links health records to the national biometric ID system (Aadhaar), indicates further investment in digital futures in healthcare [1, 44]. Privacy concerns have also surfaced with CoWin, a government web portal for COVID-19 vaccination registration, which is beginning to be integrated Aadhaar and has been integrated with facial recognition in some vaccination centers [26, 96]. We also found FHWs being recruited to inform and motivate citizens to use government applications like Aarogya Setu, despite its poor performance and significant privacy and surveillance concerns [80]. There is an urgent need for academics and citizen groups to leverage their relative power to hold government and corporate actors accountable for such initiatives.

Resistance could also entail *creating alternatives* to state-driven community healthcare. Keyes, Hoy, and Drouhard articulate a political vision for HCI grounded in emancipatory autonomy, by creating *prefigurative counterpower*—systems and spaces that exemplify the world we wish to see [9, 59]. One way to do this could be through *commoning* or “*the active nature of the commons and the commoners that are taking part in the creation and maintaining of local and global commons*” [102]. Scinanamblo et al. suggest nurturing cooperative practices through caring and commoning as means for shaping design interventions alternative to accumulation and exploitation [102]. For instance, building on current resilient practices, FHWs and community members could create a local commons to enable online and offline sharing of knowledge around locally-situated healthy practices, caregiving strategies, digital skills, and more. We caution that access to commons can also be gendered (and potentially intersect with other social identities) [19]. We saw how caring labor was highly gendered at home and in the workplace, and researchers and practitioners should take care to ensure that existing power differentials are not replicated or further entrenched.

6 CONCLUSION

We studied how frontline health workers in India navigated digitization during the COVID-19 pandemic, as they attempted to care for their communities and each other. Many countries have witnessed similar state and corporate digitization efforts in care work in recent years (e.g., with home care workers in the US [33]). Our findings revealed the top-down transition to digital workflows, the demands of digital integration, and the engagement with complex social relationships that care work entailed. Health workers’ efforts to care could also lead them to come into conflict with various stakeholders—supervisors, government officials, and even their own communities and families. Within this complex ecology, our work uncovered how health workers directed their care efforts in four ways—towards enabling their communities’ and their own *survival* within the healthcare system, building *resilience* through support networks outside the system, *advocating* for better working conditions, and *resisting* against injustices that they experienced. We suggest that researchers and practitioners align with these existing efforts to center care in technology design. Our paper thus contributes towards emergent conversations on the future of care work.

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