Infrastructuring Telehealth in (In)Formal Patient-Doctor Contexts

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Telehealth technologies have long remained on the peripheries of healthcare systems that prioritize in-person healthcare provision. The spread of the COVID-19 pandemic has foregrounded the need to formalize telehealth infrastructures, particularly teleconsultations, to ensure continued care provision through remote mechanisms. In the Indian healthcare context, prior to the pandemic, teleconsultations have been used to substitute for in-person consultations when possible, and to facilitate remote follow-up care without exacerbating pressures on limited personal resources. We conducted a survey and interview study to investigate doctors' and patients' perceptions, experiences, and expectations around teleconsultations, and how these contribute towards supplementing healthcare infrastructures in India, focusing on the changes brought about by the COVID-19 pandemic. In this paper, we describe the efforts of our participants towards infrastructuring telehealth, examining how technologies were adapted to support teleconsultation, how expectations shifted, and how the dynamics of caregiving evolved through this transition. We present implications for the future design and uptake of telehealth, arguing that COVID-19's impact on teleconsultations lays the foundation for new telehealth infrastructures for more inclusive and equitable care.

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

Additional Key Words and Phrases: Telehealth; COVID-19; Infrastructuring; HCI4D; Qualitative

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1 INTRODUCTION

In resource-rich regions of the world, the pervasive and ubiquitous nature of technology has led to a growing interest in telehealth solutions to complement healthcare infrastructures [56, 69], providing convenience as well a broader network of healthcare providers to consult. In relatively resource-constrained regions, like in many countries of the Global South where healthcare systems are persistently impacted and doctor-patient ratios remain abysmally low [5, 7, 29], technology-mediated healthcare alternatives, like telemedicine, have primarily been researched to investigate how they might address glaring gaps in healthcare infrastructures [13, 55]. In this paper, we focus on the intersection of these two worlds with their distinct motivations, where healthcare systems are impacted on account of various resource constraints (as in the South), while affordable, low-cost information and communication technologies (ICTs) are still available widely enough to render teleconsultations feasible (like in the North). We examine, in particular, the role played by the COVID-19 pandemic in facilitating the adoption and integration of telemedicine into everyday care-seeking practices in urban India.

Telehealth solutions in resource-constrained regions have historically entailed the remote delivery of health-related services through transfer of audio, video, and graphical information via

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ICTs, focusing on providing diagnoses and consultations [18, 25, 80]. Their particularly attractive affordance has been the extension of medical expertise, and provision of affordable, and quality healthcare services, to remote inaccessible areas [37, 58, 81]. Telehealth systems have been used to facilitate diagnosis, treatment, preventative health advice, health education, and training for patients and healthcare workers. Prior research has also emphasized that telehealth initiatives can make healthcare service more accessible and cost-effective [21, 55], providing insight into the factors that make a telehealth infrastructure successful, highlighting the importance of coordinating human infrastructures to manage constrained resources [13]. A common thread across this literature is the focus on telehealth as a necessity, aimed at healthcare provision as a priority. In the Indian context, prior telehealth work had primarily targeted connecting urban healthcare centers with remote, under-resourced rural areas [13, 15, 18, 25], due to existing infrastructural and geographic divides in where healthcare facilities are located and where they are needed the most [7, 68]. As a result, existing telehealth practices among technology-rich populations, predominantly in urban areas, remains understudied. With the COVID-19 pandemic redirecting healthcare resources away from regular non-emergent care, telehealth transformed into a necessity: a means for continuing care provision to patients with other health conditions. Leveraging existing practices and creating new ones in this effort became paramount. In this paper, we examine this process of infrastructuring telehealth in response to a pandemic, as taken up in technology-rich urban Indian contexts. We use 'infrastructuring work' in the framing of this paper to denote the work performed by various stakeholders, including doctors, patients, caregivers and pharmacists, in aligning, coordinating, and supporting the continued functioning of healthcare infrastructures to ultimately work for them. It follows that *ad hoc* infrastructuring signifies the work made necessary to support breakdowns in healthcare infrastructures during the initial months of the COVID-19 pandemic.

The implications of COVID-19 for telehealth are immense. Not only are healthcare systems across the world more acutely constrained than ever before, restricted mobilities have also made virtual alternatives like telehealth far more attractive [82, 95]. Throughout the year 2020, various media and research sources have detailed the impact that COVID-19 has had on healthcare infrastructures (*e.g.,* [35, 61, 73]). This sharp focus has not only surfaced the shortcomings of these infrastructures but also consequently directed attention to the potential for telehealth alternatives, like teleconsultations in lieu of in-person consultations, to play a more prominent role [45, 64]. Due to COVID-19, we find that the uptake of teleconsultations in urban Indian contexts has been on the rise. Our research presents a qualitative investigation of this growing adoption through a survey and interviews that probe the unfolding *ad hoc* infrastructuring of telehealth, as (potential) careseekers and caregivers respond to the havoc wreaked by the pandemic.

Our research investigates the effects of COVID-19 on telehealth infrastructures as it triggers a shift to telehealth approaches, extending prior work on healthcare infrastructures within the fields of Human-Computer Interaction (HCI) and Computer-Supported Cooperative Work (CSCW). We contribute a timely analysis of the infrastructuring work required of multiple stakeholders within the healthcare system to adapt to transitions necessitated by COVID-19. We focus primarily on teleconsultations, studying the changing roles, responsibilities, and expectations of doctors and patients, responding to a call by the HCI community to shed light on the invisible work of stakeholders in healthcare [16]. We also surfaced prior, invisible, infrastructuring work in setting up urban telehealth practices that supported the overburdened and fragmented healthcare systems that were made visible by the pandemic. Finally, drawing on these past successes and identified challenges, we discuss implications for the design of telehealth systems in this context, also imagining how the benefits of these might extend in more equitable and inclusive ways for the future.

2 RELATED WORK

Our work builds on multiple bodies of literature within HCI: healthcare delivery in general, telehealth/telemedicine, and infrastructuring work. We provide an overview of this related work below.

2.1 Healthcare Technologies in HCI

The domain of healthcare has been well and actively studied by HCI researchers for decades, with an examination of the collaborative nature of healthcare delivery (*e.g.,* [32, 60, 72]), and how technology design might enhance the effectiveness of the process [23]. Although much of this work has been centered on formal institutions in the Global North, significant attention has also been given to the design and deployment of relatively low-cost setups in the Global South, where cost, unreliable power and internet connectivity, minimal-to-low literacy, insufficient familiarity with technology, and various accessibility challenges routinely pose hurdles [34]. Much HCI research in healthcare focuses on technical artifacts (hardware, connectivity, clinical issues among others) (*e.g.,* [36, 62, 91]), but there is a growing focus on understanding these sociotechnical systems as a whole [10, 33]. A recent CSCW workshop [67] directed attention to the various stakeholders in healthcare, including those whose work is typically invisible, to identify sociotechnical phenomena that inform people's usage of technology. Whereas this workshop focused the increasing adoption of AI technologies in healthcare, advancing this direction of research would also provide an understanding of how modality changes to provision of healthcare, like a switch to telehealth, would affect the human infrastructures that support healthcare provision.

Within the focus on delivering healthcare, several studies have highlighted the advantages of implementing a telemedicine system, such as an enhancement in the quality of medical advice [46], more effective allocation of resources in general [69, 86], the learning and development of variously placed healthcare professionals, as well as the enhancement of professional networks [52]. This research is largely located in resource-rich environments of the North, typically endowed with infrastructural architecture that can support collaborative exchange [49]. In generally resource-constrained healthcare contexts such as India's, apart from improved quality and access to health care [22], the cost-effectiveness of telemedicine presents a significant draw. Meher and Kant [55] have examined the economic benefits of telemedicine in the Indian context, affirming that telemedicine saves both time and money and could be especially valuable for patients from lower income backgrounds. Telemedicine introduction in India, and its successes and potential have been widely documented (*e.g.,* [15, 18, 25]). In spite of these benefits, telemedicine was struggling in India pre-COVID, with failure of the Indian Space Research Organisation (ISRO)'s HealthSAT telemedicine facilities [6, 66], struggling telemedicine startups like Lybrate[1], and the Government of India reducing the 2019-20 telemedicine budget to INR 45 crores—approximately USD 6.48 million (down from INR 55 crores—USD 8.62 million—in 2018-19) [41].

Previous HCI research has highlighted several crucial though subtle aspects pertaining to video-conferencing for healthcare, including nuances related to the professional nature of healthcare service delivery and the role of sociocultural aspects of the context where the intervention is being implemented [10]. Trust has been discussed to be an important consideration of the system, and refers to both trust in the technological system [42, 46] and trust in the judgement of the caregiving professionals [52, 69]. As telemedicine becomes increasingly pervasive, connecting diverse cultural and institutional contexts, subtleties of local practices and processes must be accounted for [76]. Apart from various sociocultural and professional dimensions, issues related to technical aspects

[1]Lybrate: Ask A Doctor Online - https://www.lybrate.com/

have also been shown to impact effective collaboration, such as poor quality of audio/video [46], unreliable connectivity [69], and complexity of the system that limits its usability [85].

Challenges with telemedicine adoption have been studied globally as well. Greenhalgh et al. [28] evaluate the reasons for non-adoption, abandonment, and scaling issues of such telemedicine platforms in the UK. They present barriers to adoption of video consultations including the requirement for organizational workarounds to set up and operate video consultations in lieu of 'traditional' consultations, and technological challenges that are 'mundane but potentially prohibitive' like understanding how to work everyday devices [28]. In another study, Greenhalgh et al. conducted a qualitative analysis of the advantages and limitations of virtual online consultations in the UK, identifying a lack of attention to the *'social and material interactions occurring between patient, staff member, and technology(ies)'* [27], emphasizing the research gap identified above.

The onslaught of the COVID-19 pandemic made telemedicine necessary globally. It has revived and emphasized that telemedicine applications are similar to numerous other media spaces that involve video conferencing in various ways [3, 9]. The delivery of telemedicine amidst a pandemic can entail trivial to life-critical discussions, as well as the need to share a range of medical data, requiring levels of collaboration [85, 94]. As found previously, providing healthcare services, particularly tertiary care, entails collaborative involvement of multiple actors (human and technological), with diverse perspectives, objectives, and competencies [19]. Collaborative work involving the coordination of medical responsibilities across geographic areas through video conferencing has been researched in HCI over the years, although less in the context of the Global South [10, 19, 49, 53, 75]. An example worth noting is by Kolko et al. [49], who studied how to adapt radiological practice to hospitals in resource-constrained environments through the design of a portable mobile ultrasound system.

2.2 Infrastructuring Work for Telehealth

Star [83] defines infrastructures as a "fundamentally relational concept, becoming real infrastructure in relation to organized practices," complicating the erstwhile definition of infrastructure as a system of substrates: a part of the background that supports the working of other systems. Star and Rubhleder [84] describe these dimensions of infrastructures: its embeddedness in other structures and social arrangements, how participants learn its details through membership in a community of practice, how it is incrementally built on an existing base, and how infrastructures become visible upon breakdown, among others. Within CSCW and HCI, these concepts of infrastructures and infrastructuring—the task of combining and aligning different components of an infrastructural system to work for the user—have been used in the past to study information infrastructures (*e.g.,* [40]), human infrastructures (*e.g.,* [13, 70]), and in participatory design (*e.g.,* [71, 79]).

Recent conversations in the HCI community have highlighted how patients and caregivers are performing invisible infrastructuring work just in engaging with healthcare infrastructures around the world [17]. Gui and Chen, for example, have studied patients' infrastructuring work in engagement with healthcare infrastructures, postulating that healthcare is inherently infrastructural and fragmented and present the variety of failures and constraints within healthcare systems that necessitate infrastructuring [30], with the burden of coordination falling on the patients and caregivers [31]. Prior works in the Global South have investigated the infrastructural composition of healthcare systems [4, 88], the potential for telehealth infrastructures [11], and the human infrastructures that would support them [13]. For telemedicine systems to be successfully implemented, it is important for the infrastructural components to work as seamlessly as possible, as argued by Chandwani and Kumar in their analysis of a successful telemedicine implementation in India, as they lay out the infrastructuring work needed for the extension of medical expertise to remote locations, from

the perspective of collaboration [13]. The authors used the lens of seams to describe the issues related to juxtaposing diverse infrastructures and contexts [89]. Prior work, along similar lines, has studied the implementation of large public infrastructures such as Aadhaar [80], describing actors' experiences at the seams and their efforts to negotiate the challenges they face therein. While their focus is on the human infrastructural aspects and how these are stitched together to ensure a working telemedicine implementation [13], our focus is on our participants' additional infrastructuring work to support telehealth in the time of the COVID-19 pandemic. This involved adapting existing technologies for teleconsultations, and managing expectations and the dynamics of caregiving as teleconsultations were adopted. The pandemic has severely impacted healthcare infrastructures, straining resources [1] and delaying chronic illness care [64]. As a result, this has rekindled conversations about the potentials for telehealth in the future [43, 59, 77]. Through our paper, we aim to imagine how these infrastructured developments might introduce new possibilities for fulfilling healthcare needs for the future.

3 METHODS

With the goal of studying the changing role of telehealth in India, in light of the COVID-19 pandemic and its related mobility restrictions, we created a survey inquiring about people's past experiences with teleconsultations, their comfort levels seeking or providing healthcare remotely, and which they would prefer in a post-COVID world. The final, optional, question of the survey recruited volunteers for follow-up audio/video interviews. The study was approved by the Institutional Review Board at Anonymous Institute. In this section, we present our survey and interview methodologies, data collection and analysis.

3.1 Survey

Our in-depth online survey consisted of 45 questions, and was administered via Qualtrics[2]. It contained a combination of open-ended and close-ended questions that aimed to understand how frequently respondents (including doctors) engaged in teleconsultations and in-person consultations, what they perceived as advantages and disadvantages of these two modalities, if and how their attitudes had changed on account of COVID-19, and what mode of consultation they would prefer for non-emergency health conditions a year in the future (a post-COVID time). Some examples of the multiple choice questions for patients included: *"Since March 2020 (during the COVID-19 pandemic), how many times have you been in a tele-consultation with your doctor?"*, *"On what platforms have you had these tele-consultations with your doctors? (select all that apply)"*, and *"How confident are you of the doctor's diagnosis and decision-making in a tele-consultation?"*. The open-ended questions, for example *"List any two advantages that you think teleconsultations have over in-person consultations with doctors,"* were all optional and were included to gain an overview of the perceptions of the community about teleconsultations as well as identify topics for inclusion in the semi-structured interviews. The survey was split into three parts: the first targeted at doctors, surgeons, and other healthcare professionals who conduct patient consultations (14 questions, including 5 open-ended questions); the second targeted a general audience who had consulted with a doctor in the past year (17 questions, including 5 open-ended questions); and a common final section collecting demographic information (14 questions).

The surveys were piloted with four researchers who provided feedback on question framing and survey experience. All authors sent this survey to their personal WhatsApp groups with individuals residing in India and perceived to meet our inclusion criteria, and it was then disseminated further by members of these groups. In order to be included in the study, participants needed to be currently living in India, and been a practising doctor or have consulted with a doctor (either

[2]https://qualtrics.com

remotely or in-person) within the past year in India. In total, we received 181 responses over 30 days spanning July–August 2020. The participant demographics are available in Table 1. The survey was administered in English. The responses were, by default, anonymous unless the participants volunteered to be contacted for the follow-up interview, in which case they provided their contact information (email ID or phone number). All partial responses were deleted after 1 week from their last activity and treated as voluntary withdrawal from the study.

We open-coded the responses to the open-ended questions and analysed them using an inductive interpretive analysis [57]. We identified themes such as 'data privacy', 'payment concerns', 'lesser risk of infection', and 'prescription issues'. These emerging themes informed areas of focus in our semi-structured interviews in the next phase of the study. As a result, the Findings section of the paper predominantly draws on the interviews where quotes are presented. We will specifically indicate that we are reporting survey data where relevant. We do so in the form of quotes from responses to the open-ended questions, and demographic or statistical data from the survey responses.

Table 1. Survey Response Demographics

	Doctors (58)	**Patients (123)**
Age Range	Min (18-24), Max (65-74), Median (45-54), Mode (55-64)	Min (18-24), Max (75-84), Median (45-54), Mode (45-54)
Gender Identity	Male (38), Female (20)	Male (62), Female (59), Prefer not to answer (2)
Location	Urban (50), Semi-Urban (6), Rural (2)	Urban (111), Semi-Urban (9), Rural (3)

3.2 Interviews

We conducted follow-up interviews starting one week after sharing the survey. Out of the 181 responses, 55 participants volunteered to participate in the interview, and provided their contact information. Of them, we contacted 24, and interviewed 18 participants in a span of three weeks in August 2020. In contacting a subset of participants, we attempted to maintain a balanced sample in terms of age and gender. We recruited doctors from different specialities to allow for plurality in experience and perspective. As our intention was to understand the changing role and expectations of teleconsultations in healthcare, we also wanted to interview participants who had not had any teleconsultations before, and included one such participant (P3) who had expressed speculative opinions about teleconsultations in our interviews. We stopped recruiting interview participants when our data reached saturation. Summarized information about the interviewees is available in Table 2 and Table 3. In the rest of this paper, all quotes from doctors can be identified by pseudonyms beginning with 'D'. Other participants' pseudonyms begin with 'P'.

In the interviews with patients, we asked about their experiences with teleconsultations before and during the COVID-19 pandemic, if any. Specifically, we asked about the modality of these consultations, how information was shared between them and their doctors, and how they paid for these teleconsultations. Next, we asked the participants to compare these teleconsultations with in-person consultations to identify benefits and challenges. In the interviews with doctors, we asked about their consultation practice before COVID-19 pandemic and any consequent changes to their practice, including barriers to change and new opportunities due to these changes. We asked specific questions about the information they sought from patients during their teleconsultations, how prescriptions were provided to patients, and how their patients paid for the teleconsultations.

All interviews were conducted remotely by the first author, with most being WhatsApp audio calls, and some being WhatsApp or BlueJeans video calls. They were audio-recorded on a separate device with the consent of the participants. The interviews lasted 30–75 minutes. The interviews were primarily in English, with a few in Hindi and Kannada based on the participants' preference. The interviews were transcribed, and translated to English as necessary, soon after they were conducted. All participants' names have been anonymized in this paper. Participants were not paid for participation.

We analyzed the interview transcripts using an inductive and iterative approach. All authors periodically discussed the interview data to identify emerging themes. We used an inductive, interpretive coding approach to this data [57]. Initial themes included 'information privacy', 'fee payment issues', and 'prescriptions'. We iterated over the data to produce higher-level themes including 'technology infrastructures' and 'human infrastructures'. Ultimately, we abstracted out to three main themes to present in this paper: the shift in technology use in response to the pandemic, the shift in expectations among stakeholders, and the shift in dynamics of caregiving as it evolved in the process of transitioning to teleconsultations.

Table 2. Interview Demographics: Patients
TC: Teleconsultations; Pre-COVID: Between April 2019 and March 2020; Post-COVID: After March 2020

	Gender	Age Range	Location	TC Pre-COVID	TC Post-COVID
P1	M	35-44	Bangalore	1-5 times	Never
P2	F	25-34	Bangalore	1-5 times	1-5 times
P3	F	35-44	Bangalore	Never	Never
P4	M	35-44	Bangalore	1-5 times	1-5 times
P5	F	45-54	Bangalore	1-5 times	6-10 times
P6	M	55-64	Noida	Never	1-5 times
P7	F	25-34	Bangalore	Never	1-5 times
P8	M	45-54	Bangalore	1-5 times	1-5 times
P9	M	18-24	Kolkota	Never	6-10 times
P10	M	55-64	Bangalore	6-10 times	1-5 times

Table 3. Interview Demographics: Doctors

	Gender	Age Range	Location	Specialization
D1	F	25-34	Chennai	Reproductive Medicine
D2	M	55-64	Bangalore	Cardiothoracic Surgery
D3	F	35-44	Bangalore	Dermatology
D4	F	55-64	Bangalore	Gynecology
D5	M	25-34	Bangalore	Gastro Intestinal Surgery
D6	M	55-64	Hyderabad	Dermatology
D7	M	55-64	Bangalore	Neurology
D8	M	55-64	Bangalore	General Physician

3.3 Positionality

All authors have been conducting research on health informatics in the Indian context for several years, and have studied the role of culture and technology in shaping healthcare practices. The

research we present in this paper was motivated by the shift we observed towards gradual acceptance of telehealth solutions in light of the COVID-19 pandemic. Having studied healthcare solutions among underserved populations in rural and urban India, we were drawn to investigate the uptake of telehealth and its potential for equitable and inclusive healthcare offerings in the future. Although the latter is a much more long-term goal, we state it here in the interest of revealing our positionality as we designed our research plan.

4 BACKGROUND: TELEHEALTH IN INDIA

Before presenting our findings, we draw on prior literature to provide a brief background to the healthcare infrastructures in India, socioculturally situated practices within, and how teleconsultations had been operating prior to COVID-19. Then, we situate our study within the timeline of COVID-19-enforced changes to activities. This not only contextualizes our findings in the existing healthcare practices but also highlights the additional infrastructuring work introduced by the COVID-19 pandemic.

Various aspects of the Indian healthcare system have been the subjects of focus of HCI research in the past. Chandwani and Kumar [13], in analyzing the human infrastructuring that enables telemedicine, provide a brief overview of the three-tiered governmental health infrastructures: primary healthcare centers in villages, secondary healthcare centers in *taluks* or sub-districts, and tertiary healthcare centers in the district headquarters (including urban regions). Primary health centers are equipped to provide consultations and conduct basic procedures. Any conditions requiring specialized care are referred to secondary healthcare centers and, for more specialized and critical care, to tertiary healthcare centers. Alongside this public health system, the private sector ranges from individual clinics to multispeciality hospitals across geographic regions, albeit concentrated in urban regions [20]. Last-mile healthcare coverage to rural and other under-equipped regions is provided by a network of frontline healthcare workers called Accredited Social Health Activists (ASHAs) and their roles, responsibilities, and practices have also been previously studied (*e.g.,* [38, 39]). There exist strong power dynamics in patient-doctor interactions where doctors are traditionally considered 'experts', though the widespread availability of information technologies [12] and health tracking technologies [8] are complicating these dynamics.

Telehealth practices in India have historically taken the form of voice and video-based communication between healthcare providers in urban and rural areas for providing remote expertise, remote screening for diseases, mHealth etc. [25]. These practices existed in tandem with traditional, in-person healthcare acting as mechanisms to provide follow-up care to patients from remote areas and identify people requiring in-person care. The strains on the healthcare infrastructures introduced by COVID-19 engendered increased adoption of telemedicine practices in lieu of traditional consultations which were made infeasible due to lockdowns and reduced mobility. Enabling this transition was the Telemedicine Practice Guidelines introduced by the Ministry of Health and Family Welfare in India, released on 25th March 2020 [65], in which medical practitioners were given greater discretion in choosing technologies to provide teleconsultations, diagnoses and prescriptions. These guidelines 'legitimized' the use of commonly used mobile platforms like WhatsApp for teleconsultations [24]. Recent research has explored the possibility of text messaging applications in general [26, 54, 90], and WhatsApp in particular [93], playing a greater role in telehealth, while also expressing reservations about their adoption[87]. Within the Indian context, prior works have focused on WhatsApp as a means for coordination among nurses in hospitals [47], as well as dermatologists in discussing cases leveraging its photo sharing feature [44]. With these recent changes to guidelines allowing for more wide ranging uses of WhatsApp, our study allowed us to uncover opportunities and challenges arising out of its adoption in telehealth. Our study was conducted in July and August 2020: 4 months after new guidelines were provided. India enacted

a nationwide lockdown due to COVID-19 on 25th March 2020, which lasted, to varying degrees, until 31st May 2020, followed by gradual reopenings [92]. This study, therefore, was conducted at a time when transitions of telehealth measures were underway and telehealth had become viable alternatives to in-person care.

Our related work section covers the various challenges to telemedicine adoption in India stemming from issues like trust, cost, and ICT infrastructures. Our preliminary findings from this research indicated that, despite these shortcomings of telemedicine systems, there existed sociotechnical telehealth processes that were infrastructured by doctors and patients, before the pandemic, in order to work around the constraints of the health infrastructures like long waiting times and overburdened healthcare practitioners. For example, we noted that it was a common practice for doctors to share their personal contact information with their clients. Our survey respondents (34/36 (94.4%)) of patients who had received teleconsultations before COVID-19 indicated having had teleconsultations *"through direct contact with the doctor through personal/professional referral (e.g., via phone calls, WhatsApp, etc.)"* ostensibly by virtue of having this contact information. Doctors concurred, with 31/46 (67.4%) who had provided teleconsultations in the past year having done so via voice calls, and 28/46 (60.9%) doctors via text messages. These were predominantly unpaid consultations, as we present in the Findings, with most being follow-up consultations and discussions of lab reports. Although several telehealth and mHealth technologies have entered the market in the recent past, they have not been widely adopted [24].

5 FINDINGS

Our findings detail the efforts of our participants that went into infrastructuring telehealth as a consequence of the restrictions imposed by COVID-19 control measures. We describe how technologies were adapted to support teleconsultation, how expectations shifted, and how the dynamics of caregiving evolved in the process of transitioning to teleconsultations. We indicate what practices existed before the pandemic, as described by our participants, and where additional work was necessary to make telehealth possible for situations that differed from earlier practices.

5.1 Shifting Technologies in Response to a Pandemic

As COVID-19 hit and teleconsultations became necessary, participants reported relying on WhatsApp to support them first as they repurposed a familiar existing communication mechanism. Aforementioned changes to Government guidelines [65] empowered doctors to not only have logistical conversations with their patients but also provide diagnoses and prescriptions. The use of WhatsApp (also explored in prior research *e.g.,* [26, 54, 93]) raised several challenges, however, leading to the adoption of bespoke teleconsultation platforms that had their own downsides. This section delves into how technological infrastructures were set up and/or adapted to provide teleconsultations.

5.1.1 "We have been consulting on WhatsApp": WhatsApp Use for Teleconsultations.[3] Our findings confirmed that teleconsultation is not a new practice, and has been around in some shape or form for decades. Before smartphones and WhatsApp became widely used, phone calls were the primary medium of teleconsultation. Over the years, and especially on account of the COVID-19 pandemic, other modalities have also become commonplace, as detailed below.

Technology infrastructuring for direct communication between patients and doctors has been a priority for several years, and was catalyzed by the introduction of WhatsApp[4] in India. When

[3]We are using in vivo codes [14]—direct quotes from participants—as section headings in this paper to denote the findings they present.

[4]WhatsApp was launched in India in 2010, and crossed 100 million monthly active users in 2015.

asked about how long D4 had been offering teleconsultations, she explained, *"That has been going on, on and off, from the past many years... ever since this WhatsApp and things came up, and ever since the mobile phone came up. We have been consulting on a mobile phone and WhatsApp."* Such conversations, typically phone calls, were considered 'follow-up' consultations that focused on discussing results of diagnostic tests, and negotiating dosages of medications based on test results. The introduction and proliferation of WhatsApp caused these conversations to become asynchronous, allowing both doctors and patients greater flexibility in having these conversations. Features built into WhatsApp for sharing images and PDFs have aided these teleconsultations by enabling patients to send in medical reports and other relevant documents for doctors to peruse before or during the conversation. For example, P4 explained:

> "[My older experiences with teleconsultations] are mostly some WhatsApp messages... We take a photo of the prescription from last time, 'Doctor you'd given this [last time]. What do I do now?'... [So,] I can take a photo of it, or I can tell the doctor that 'this is my worry.' And the doctors responded... prepared [for the consultation]" (P4)

During the COVID-19 pandemic, many survey and interview participants indicated a shift towards teleconsultations as healthcare institutions (that were not on the frontlines of COVID-19 care) experienced an overall reduction in patient volume for voluntary procedures and care. 32 patients (N=123) indicated an increased frequency of teleconsultations since March 2020, when compared to earlier. 14 doctors (N=58) responded as conducting only teleconsultations, and 20 doctors indicated an increased frequency of teleconsultations in the same time frame.

D1 shared, *"Initially for one month, there was a lot of confusion. We didn't know what to do, how to see our patients... our department deals with people who are trying to conceive. So it is not an emergency condition. So, it was only in late April and May when the patients are calling and asking 'what has to be done?'... that's when we started teleconsultations."* With this shift there was a growing uptake of higher fidelity channels, such as video calls, or voice calls with videos previously shared. For example, D6 said:

> "What I do is first... I'll ask the patient to send his or her details, with a photograph... and the problem involved. And then I asked him to give a small video of the problem... When I see the patient sends [photo, video, screenshot of payment], maybe within half an hour, one hour I see the patient. I talk to them. First I'll talk to them by normal phone. Because you know, the audibility is clear in the normal phone..." (D6)

With this rising uptake of teleconsultation during the pandemic, we found that digital information increasingly acted as a proxy for physical examinations, depending on the type of ailment of course. D3, whose specialization is dermatology, described her usage as follows: *"So it's a visual... kind of field. So most of the times [my patients] would send me pictures... of their diseased part and then... we would take from there."*

Our findings affirmed that patients and doctors had created workarounds that could make teleconsultation feasible. These sessions, asynchronous or not, were also viewed as having the positive affordance of cutting down time spent in traffic and in the waiting room when having to be seen at a doctor's clinic/hospital for an in-person consultation. Long waiting times adversely impact patients' experience [50]. Several survey respondents listed this as a perceived benefit of teleconsultation. Technology repurposing for teleconsultations, however, did not come without its challenges. For example, D3 explained that video did not suit her needs:

> "And video consultation... one problem is the clarity is not that great... with the present apps which are available. I'm not very happy with the clarity of images that we can

> see…because…the resolution is not too great…It's a little blurred, and I would want to get a good clear picture of the rash before I could give my diagnosis." (D3)

D6 also mentioned that patients sometimes struggled with using video: *"My problem with [video consultations] is patients don't know where to put the camera! [If] the person is showing his leg…He doesn't know to where the…that is why…the earlier [video] would be helpful for me."*

Overall, our findings indicated that our participants were not new to teleconsultation when the pandemic first hit; this helped them adapt fairly quickly through the use of platforms (*i.e.*, WhatsApp) and modalities that were already familiar to them. This process was not without its challenges, however, as participants found themselves having to adopt new workflows to ensure a successful consultation. Below, we will unpack some challenges introduced in this process.

5.1.2 "Handling the WhatsApp": Implications of WhatsApp Exchange of Patient Data. WhatsApp for personal communication in India has previously been documented to highlight that sharing information, memes, and greetings via messages are pervasive practices, requiring active content management on devices [74]. Widespread repurposing of WhatsApp in teleconsultations, as mentioned above, meant an overlap in personal and professional usage behaviors. Adoption of personal tools for work has been discussed previously with respect to WhatsApp use by nurses in India [48]. We present our findings on the ramifications of such an overlap on usage patterns, and health data privacy.

Medical reports and images, when shared with doctors, could serve as documentation of consultations provided, necessitating their retention. In D5's case, this manifest as a *"WhatsApp full of pictures."* However, phones routinely require storage management for improved performance. D4's WhatsApp management practices consequently affected her consultation records as well. She explained, *"…after reading the message and replying to them, I just delete the whole chat itself. It occupies a lot of space on my phone that's all (laughs)"*. Another participant explained how he managed consultation-related WhatsApp data that he received: *"actually some people…erase it immediately. Until now I didn't do [that], but my wife was saying 'you're just dumping the phone with so much of stuff.' So one day, she sat and (laughs) erased all the old WhatsApp [conversations]"* (D6).

D6's case also highlights potential privacy implications around access to sensitive medical information. When asked if there were privacy considerations with regards to sending identifiable images and medical reports on WhatsApp, a participant said, *"in the doctor–patient case, the diagnosis is more important than the steps involved. So the trust is the key factor here"* (P1). While we did not investigate how this trust is developed, our survey participants were largely comfortable (40/123, 32.52%) *with the idea of trusting the doctor, and receiving tele-consultations from doctors whom [they] do not meet face-to-face.* Only 17 responses, (13.82%) indicated being uncomfortable with the prospect. This sense of trust was in spite of the fact that the sender had no knowledge of how their information might be handled post-consultation. One survey respondent pointed out that *"some of your very personal information is shared on [WhatsApp] which is available to the assistants who handle the [WhatsApp] of the clinic"* (S5). Regardless, S5 also expressed a preference for teleconsultation over in-person consultation due to the logistical benefits it entailed. Several participants recognized that their doctors were extremely busy and being able to seek care remotely was of paramount importance, privacy concerns or not.

When consultations were of a more private nature, participants did discuss measures they took to ensure the privacy of shared data and media. Participants like P2 proposed the need for features such as deletion of sensitive images in the case of gynecological consultations, saying *"I'm not sure how many gynecologists can diagnose by pictures but…But hypothetically speaking…maybe [we need] a feature to…delete the picture after a few seconds…and make it non-shareable, non-screenshottable etc."*. D3, a dermatologist, recounted an experience with a patient who used WhatsApp's *Delete*

for everyone feature to provide her with sufficient information to make a diagnosis while also protecting privacy of sensitive information:

> "So recently I had another patient who…who had seen a lot of doctors…nearby…and she had some rashes and her private parts. So I said, 'See, listen, I cannot give you my opinion unless I see those rashes.' So she said, 'Okay, fine, I'll send you those rashes *ka* pictures.' So she sent them to me, but then she immediately deleted after I saw and I gave her [my] opinion…so she immediately…you can do that right? You can delete the picture, so she did that!" (D3)

Some participants discussed audio/video-recording consultations as these could provide accountability and transparency to their consultations in ways that in-person consultations did not. P4 explained that this could be beneficial for both doctor and patient as they could hold each other accountable. Some doctors were on board with such recording but others were not. D4 recounted:

> "In the clinic only nowadays, they record whatever we say and maybe they hold it as evidence against us. So it is scary in the clinic also. I'm sure these [teleconsultations] they may be recording, I don't know.…I have had one or two instances when they [patients] have come for a second opinion or they want to blame me or some other doctor…whatever I say has been recorded, taken to the other doctor, and I have got calls from the other doctor saying 'this is what you said to this patient. Is this how you manage [this condition]?' " (D4)

We saw overall that although WhatsApp presented the most popular resort for enabling teleconsultation, given that it was already a widely prevalent mode of communication, there were also challenges that it presented in terms of information management. Not only was there too much unstructured content generated from consultations that was hard to manage (with deletion being the easiest recourse), there were privacy implications to be recognized and navigated, and litigious issues to be wary of. Next we discuss the formalization of teleconsultation platforms, beyond the familiarity and comfort of WhatsApp.

5.1.3 "Use Practo to Book an Appointment": Emergence of Telehealth Platforms. The COVID-19 pandemic has catalyzed and necessitated the growth of hospital- and third-party-teleconsultation infrastructures to enable doctors to continue providing care during periods of restricted mobility. WhatsApp communication was a popular workaround for many but there were concerns as listed above that made it challenging to use at the institutional level, particularly in cases where there were not already existing ties: between doctors and patients, and between hospitals and patients. As D1 pointed out, *"So where there is no money in, how can money go out? So that was another issue why they decided that we will do teleconsultations."* These teleconsultations typically provided the patient with an option of different modalities like audio, and video consultations. They could be scheduled on the hospital's website, or through calling the hospital by phone. D1 explained the mechanisms of the call as follows:

> "Okay, so that [institution] website has a inbuilt software…that allows for video calling. It's like a Zoom call…So they share that particular password to the patient as well as the doctor. So we just log into our hospital portal…and through that portal only we just get the call." (D1)

The setup at D1's hospital meant that patients could not directly send reports or images to their doctors through WhatsApp. Instead, patients had to email their reports to an email ID managed by doctors at the hospital. In some hospitals like D2's, patients would not be able to speak to a doctor of their choice but the doctor "on teleconsultation duty" at the time. As a result, the technology

facilitating such institutional teleconsultation systems tended to deter trust and the growth of patient-doctor relationships.

Platforms like Practo[5] and Tata Health[6] were popularly used by participants and consolidated several desired features into a single interface, allowing patients to choose doctors from different hospitals, schedule a consultation remotely or in-person, as well as pay the doctors their consultation fee. These very features were helpful to P9 when he and his mother, on separate occasions, got screened for COVID-19. He described his experience as follows:

> "So in Tata Health…I underwent a free teleconsultation with doctor via chat in the app itself. And she asked about which medicines I was taking and I said that 'Vitamins and Zinc.' So she says that 'it's okay, and if you have high fever, then only take paracetamol. And no need to do testing if you don't…if your symptoms don't worsen or you don't develop new symptoms'…they connected me to a doctor in about one or two minutes…the doctor replied, 'I am this this doctor, MBBS. How can I help you?' " (P9)

Such platforms, in theory, provided a convenient way for doctors to transform their regular practice to teleconsultations as several administrative aspects were already built into the apps. In practice, however, their usage is more complicated as they are integrated into existing sociotechnical infrastructures of consultation. P4, who contacted his doctor directly (*e.g.,* using WhatsApp) to schedule a teleconsultation was told to do it through the Practo app for convenience. He was, however, unable to do so, since it didn't accurately reflect the doctor's availability and he was unable to find a consultation slot. The doctor had to find creative workarounds to accommodate his appointment and process his fee payment. P4 recounted:

> "He said, 'No, you do one thing. To this number, pay the consultation fee using Google Pay. Take a screenshot and send it to me on WhatsApp, and then I'll talk to you'…So this was weird…Most of these aggregator apps will have the online payment option…[where] I can pay online and then I can confirm my appointment. But since the app was always telling that doctors not available at this time, I had to do the…*jugaad* (workaround) aspect of it." (P4)

Further, these platforms were not always the most straightforward to use. In spite of all their benefits towards formalizing the teleconsultation infrastructure, their usage still required an advanced technology literacy. Comparing such platforms to the more frequently used WhatsApp, D6 said:

> "I've gone [through many] portals…They're all meant for people who are little hi-fi. See…you have to give a link to a patient. The patient will open the link, and…[for that] they should have an email and then, that one, this one…I don't think [it's easy to use]…WhatsApp is very easy thing. You talk to them: 'Sir, I'm coming [or] I'm not coming. This is the doubts.' [You] finish [the consultation] off fast." (D6)

As established earlier, WhatsApp was far easier and more comfortable to use for participants because they were much more accustomed to its interface and attributes. However, it did not fulfill all teleconsultation needs and was replaced by institutions as they adopted teleconsultations, and platforms such as Practo and Tata Health that doctors turned to for convenience. These, of course, were harder to use and ended up being supplemented with clunkier solutions as with P4 above.

[5]Practo: Say Hello Doctor! 24/7 Video Consultations – https://www.practo.com/
[6]Tata Health: Chat with a Doctor Now – https://www.tatahealth.com

Having described the technologies that were used, repurposed, or designed for teleconsultations, we shift our attention to the changing interpersonal dynamics among stakeholders involved in consultations, drawing focus to their infrastructuring work in facilitating teleconsultations.

5.2 Shifting Expectations around Patient-Doctor Exchanges

The teleconsultation behaviors we presented above were largely informal insofar as they were mostly unpaid (especially when conducted via WhatsApp), used to provide doctors with updates on health, and intended to determine when a subsequent formal in-person consultation could be performed. The COVID-19 pandemic has resulted in teleconsultations transcending their role as informal interactions, and supplanting formal in-person consultations as measures are taken to stem the spread of the virus. Teleconsultations are being used not only to change prescriptions or schedule appointments, but also to make diagnoses based on symptoms observed by the doctor or expressed by the patient. We present the infrastructural gaps surfaced by this transition, and their effects on teleconsultations.

5.2.1 "We are trained to see patients in person": Upskilling for Online Consultation. Diagnosing patients is a highly specialized skill that doctors acquire after years of formal education. D7, who is in a teaching role at a medical college, explained how his training assumes the physical presence of patients at the time of diagnosis:

> "It is much easier for me [if the] person is there in front of me. It is also possible that…the way we are trained. We are always trained to see people in-person, make a decision there, and explain to them face-to-face. So, obviously, [it is not easier to teleconsult] because we cannot examine them. That's a lacuna." (D7)

In its current form, therefore, several doctors opined that diagnostic teleconsultations could not fully replace in-person consultations in a post-COVID world. They saw teleconsultations, now, largely as a stop-gap. This was evident from the survey responses as well. 40/46 doctors who have provided teleconsultations during the pandemic found it at least 'somewhat effective'; however, averaging over all responses, doctors were much less likely to voluntarily choose a teleconsultation in the post-COVID scenario when compared to patients (t-statistic: 4.404, p-value: 1.82e-5). A survey respondent captured this sentiment in this way:

> "Examination which is an integral part of reaching a diagnosis is impossible with telemedicine. Hence management will be inadequate and sometimes even inappropriate…It is a good alternative as many people are home-bound. Particularly so if it's consultation to follow up on a diagnosed condition. But if it is a new illness, it would always be better if the patient made the first visit to the doctor, thereafter followed up by phone." (Anonymous survey response, Doctor)

The burgeoning use of teleconsultation for diagnoses, where possible, is necessitating changes to doctors' diagnosis skill sets to accommodate for the physical absence of the patient. Currently, doctors are engaged in ad-hoc infrastructuring work by modifying their diagnosis strategies and workflows using features of their teleconsultation technologies as described earlier. D4 explained how she prioritized the history-taking process more, as that allowed her to *"formulate what all to expect, what all could be there…So more history, more questions, and try to treat based on their history"*. She further explained the risks of such an approach were high, as misdiagnoses could stem from exaggerated expression of symptoms that could not be verified by a physical examination by the doctors—a routine activity during in-person consultations.

Introducing these risks to teleconsultations was the difficulty of explaining one's symptoms to the doctor. As P7 explained, *"not everybody has…basic medical knowledge! You might not know…how to*

even put it in terms to… tell the doctor what you're feeling!" For patients, this knowledge is typically gained during consultations where doctors introduce them to the vocabulary needed to describe their symptoms. P5 described how having this knowledge from a previous consultation, enabled her to have a productive teleconsultation with her doctor as:

> "I've already read up on the condition, so I could describe it exactly. I knew the difference between flashing pain and radiating pain… by [that] time. So if I hadn't told the proper kind of pain I was experiencing, I don't think diagnosis will be easy for them" (P5)

This experience demonstrated a deadlock that curtails the effectiveness of diagnostic teleconsultations for new symptoms because the ability to describe symptoms is inherently dependent on their having visited a doctor for similar symptoms in the past. Currently, this problem remains without a viable solution as teleconsultations take root as a part of the formal health infrastructure.

Finally, doctors employ a wide repertoire of approaches to communicate with patients, over time identifying and persisting with those that are the most effective. Frequently mentioned in the data was the 'healing touch', a performative diagnostic process that appeals to patients' expectations of a consultation. A participant noted that with teleconsultations, *"the counselling part will be missing. The relation may become very objective… humanness will be missing"* (Anonymous survey response). These issues are exacerbated by design choices on bespoke teleconsultation platforms that employ a universal design that do not sufficiently account for varying diagnostic processes. They necessitate additional infrastructuring work on the doctors' part to calibrate their in-consultation practices for the affordances of the technology they use. D3, who expressed that she preferred spending more time with patients getting to know them when consulting in person, explained:

> "This history-taking and knowing-the-background of the patient doesn't happen very comfortably over your phone… because you're bound by a time [limit]: 15 minutes is what you get [on most of these platforms]… So you have to rush, you have to get to the point." (D3)

In case, despite changes to history-taking and diagnosis, the consultations were about to exceed the 15-minute slot the patients were provided, the systems were inflexible in accommodating such scenarios. D3 recounted a recent instance where her patient was so engrossed in communicating his symptoms that it took up 14 minutes of his 15-minute slot. With no option to dynamically lengthen the consultation, she had to *"quickly ma[k]e a note of his [phone] number because in case… I'm not able to get in touch with him through the video again, at least I could call him."*, resorting to alternative mechanisms to complete her consultation. Whereas the design choices for these technologies might be justified, with several interviewees expressing that their consultations seldom exceeded 15 minutes, a lack of flexibility and inclusivity to doctors' varying consultation practices hinders effective care provision, requiring its users to build infrastructures around these systems to fill these gaps.

In sum, we identified the reasons for resistance to a transition of consultations online encompassing doctors' training and ability to perform comparably well on teleconsultations, and the affordances of teleconsultation technologies that hamper their diagnostic process. We also identified how patients are constrained in their ability to assist in this process by virtue of it being fully online.

5.2.2 "It is awkward to ask for payment": Challenges of Developing New Practices during Teleconsultations. One important concern raised by several doctors was that of not receiving payment for providing teleconsultations, despite the existence of technologies to do so like Google Pay and PayTM. We found that the prior infrastructuring work, that introduced teleconsultations as typically unpaid supplements to formal consultations, now hinders conversations regarding payment for

services. There were no accepted norms regarding payment for teleconsultations in the past, as P4 recounted:

> "I didn't [pay for the consultation] (smiles). It was more like a goodwill gesture from the doctor. So like… 'Doctor, this is an emergency..…Please help me. This is happening.'…The next time that I went and met her, I did ask her about the consultation fee. She's like, 'What? What is all that?' " (P4)

During this pandemic, when consultations are mostly occurring via WhatsApp and other platforms, doctors are faced with the decision of needing to explicate payment procedures. Some doctors explained that it is particularly difficult for them to set these rules because they see their work as 'service', and consequently choose to treat this pandemic as a time for philanthropy or other such 'goodwill gestures'. D2, who follows this approach, justified it saying *"If they take a consultation, it's OK. Let them not contract the disease. Let them not increase the number of the infected patients, let them not end up in a hospital where there is scarcity for ventilators in case they need one."*.

Even doctors who expected to receive payment for services provided found it difficult to have those conversations with patients. Explaining that patients would read the nature of the conversation differently from them, D4 explained:

> "They think that they have just talked one sentence, or one-two minutes, they have had a conversation and clarified some doubts and things like that…They feel that they need not pay. They feel it's just a chat. That is how they perceive it." (D4)

She further explained how these processes are infrastructuralized in the in-person setting of her clinic, and the institutionalized setting of the hospitals she teleconsults for. When talking to patients *"through the hospital, they are mercilessly told to pay and then only…they get to talk to the doctor. I can't be so…I'm not comfortable"* (D4). This distinction throws light on the need for cultural/behavioral changes in attitude towards teleconsultations that obviate the awkwardness around requesting payment for service provided. These conversations are sometimes initiated by patients themselves, making the discussion easier for doctors. P6 explained an instance where he talked an unwilling doctor into a teleconsultation when he perceived that the resistance originated from the awkwardness to ask for compensation, saying *" '[we can] video call…and we can make your payment also online.' After confirming that we will be making payment (chuckles), he got interested. He said 'okay' (laughs). Because otherwise, online consultations normally…you're not paying to doctor."*

In sum, this section describes how sometimes tacit expectations and cultural norms around remuneration for services provided make up a crucial missing aspect of the teleconsultation infrastructure, even in the presence of the technology infrastructures that could facilitate it.

5.2.3 "The doctor can utilize his free time to treat us": Blurring Boundaries between Work and Home. Using personal communication media for teleconsultations introduces additional challenges regarding where boundaries are drawn between work and home, especially for the doctors. We have already analyzed how these spheres of life overlap in the context of WhatsApp use in section 4.1. Below we present how these overlaps set unrealistic expectations on the doctors and the teleconsultation infrastructures.

As described earlier, teleconsultations before the pandemic were mainly peripheral, and supplemental to formal consultations. As a result, they were short information exchanges conducted outside or alongside doctors' primary working hours, which were dedicated to in-person consultations. With teleconsultations increasing in scope and increasingly supplanting in-person consultations during the pandemic, these practices carried over from a pre-pandemic era are acting to further burden doctors' workloads. P8, for example, argued that an advantage of teleconsultations is that he is able to avail his doctors' services at times when they're both 'free', explaining *"instead*

of going all the way to [the hospital, it is] better to take rest or [engage in] constructive activity rather than visiting doctor". Continuing that this would benefit the doctor as well, he suggested that doctors now had the option to conduct multiple teleconsultations in parallel, and at any time of the day or week they prefer.

These porous boundaries between work and home were problematic to doctors who then experienced insufficient time away from work. D4 described how her experiences teleconsulting for hospitals during the pandemic allowed her to set these boundaries:

> "They disturb us at all odd hours…They don't think what time of the day [it is]…or what the doctor could be doing? They just call whenever they feel like [because] they want the answer immediately. That is the disadvantage of teleconsultation. In the hospital setup…they give us a time [slot like] 11am to 12pm, and only in that time we are available. So that is the advantage of teleconsulting conducted through the hospital. Whereas when it is us [directly], they can disturb us at any time." (D4)

Fuzzy boundaries also lead to unrealistic expectations of the physical environs of the doctor during a teleconsultation, which were not problems when most teleconsultations were either asynchronous through messages, or as phone calls. Now needing to conduct video teleconsultations, many doctors expressed that they do not designate a particular spot for teleconsultations, and are typically in their homes or clinics during calls. D5 was among the few who did use specific locations in his house, explaining that he chose to *"sit against a wall at home"* to remove any visual distractions from the conversation. Patients, however, mentioned that such environmental factors play a major role in satisfaction during teleconsultations. P4 recounted his teleconsultation experience that left him "put-off" due to such factors:

> "I did a Skype call with the doctor. Doctor was chilling in his house. Like *actually* chilling…He had a nice easy chair, or probably a recliner. He was sitting there. And he had this fixed camera which was looking at him. So you could actually see the doctor like this (Scene: camera facing downwards on the doctor's face, the doctor reclining on an inclined chair with an arm behind his head), and he's talking. I'm like, 'okay…so are you even serious about what I'm trying to tell you?!' " (P4)

Remarks like this showcase the additional labor doctors must put into infrastructuring teleconsultations with their patients, ensuring that the non-verbal cues generated are not too divergent from patients' expectations.

5.3 Shifting Dynamics of Caregiving

Having shown how technology infrastructures have been adapted to enable teleconsultations, and the challenges this transition has introduced to the consultation process, we now switch our attention to caregiving practices and how these transitioned along with the move to teleconsultation. In the Indian healthcare context, recent HCI literature has explored the human infrastructuring work that supports telemedicine [13], and how existing relationships and power dynamics are affected by an increased proliferation of information and communication technologies [12]. In this section, we extend this literature to present how previously existing relationships are flexible to changes in consultation practices, and the tensions such changes introduce within these relationships.

5.3.1 "I just call my family doctor": Changing Nature of Patient-Doctor Relationships. Healthcare infrastructures in India are overburdened, with insufficient highly specialized doctors, and a strong urban skew in their presence [7]. With such strains on the healthcare systems, infrastructuring work by doctors and patients is essential to devise approaches to regulate the burden on these systems.

Family doctors frequently act as the first point-of-contact in case of a person's ill-health. They provide preliminary diagnoses and recommendations to their patients to the best of their abilities, even for symptoms and illnesses that are outside their specializations. Based on necessity after this initial stage of treatment, they direct their patients to a specialist. P6 who was receiving treatment for an orthopedic issue explained this process as:

> "We have a family doctor…very well known to us. He was not in India [at the time]. So we talked to him on WhatsApp, and he said, 'you get some tests done, and then we'll see.' We got all those tests done…Then those reports were sent to orthopaedic [on his suggestion]" (P6)

Family doctors and their patients have developed long-standing relationships across multiple years and generations. P7 explained how family doctors are like family friends who have *"known your [medical] history, who's probably known your parents' [medical] history as well…[and] is connected with your family for so long."* These doctors are not necessarily trained as 'family medicine' specialists. They are specialists in various other areas of medicine, but are engaged in negotiating these existing social and professional ties to provide immediate care. P7 explained:

> "Say I want to see the doctor…I've my family doctor who is a dentist. I could just call and tell him, 'I'm coming in today,' and he'll be like, 'Sure, you can come in.'…If I want to see [a doctor] that very day, I can still do it because I personally know him." (P7)

These family doctors are important for connecting patients to appropriate pathways, based on their medical needs at the moment. These informal relationships, built over years of mutual trust, must also be factored into teleconsultation setups. With consultations moving online, the practices of establishing trust in new doctors and building relationships will also change. Preconceived notions regarding telehealth platforms and their verification processes hindered its popularity. In his survey response, An anonymous survey response explained, *"The actual qualification and experience of teledoctors [is] not properly known…Some [crooks] may be mischievous."* These concerns were echoed by P9 in the interview, where he explained how, in cases where he had to consult a doctor through an aggregation platform, trust in the doctor stemmed from trust in the platform itself:

> "We trust everything about Tata [Health]…because Tata is such a organization that is for human welfare…they always have good motive, to the service of mankind. And that's why I think that they will always verify the doctors who are there [on their platform]." (P9)

He continued, explaining that without such proxy indicators of trust, he would be more uncertain about teleconsultations. P3 too explained how she only visits doctors who have been recommended to her by her social circles. Establishing this trust virtually takes longer as non-verbal communications and other affective signals are harder to communicate fully virtually. This, in turn, bodes poorly for building *new* family doctor relationships as teleconsultations become more mainstream. Here, we presented how patients leveraged existing long-standing relationships with their family doctors to seek preliminary medical help. We then explored the implications of a shift to teleconsultations on the ability to establish trust in doctors, and eventually the formation of such deeper relationships.

5.3.2 "My neighborhood pharmacist": Changing Responsibilities of Pharmacists. Pharmacists are crucial members of the healthcare infrastructure, responsible for coordinating between governmental policies and changing regulations regarding drugs, doctors' prescriptions, and their relationships with their customers. Many pharmacies are located near doctors' clinics to create an ad hoc pipeline for patients to purchase medications prescribed at these doctors' clinics. These relationships are

important as they allow doctors to ensure they are able to prescribe the drugs and brands of their choice to their patients. D8 has had a primarily teleconsultation practice since 2012. He explained how his neighborhood pharmacies were initially unsure of how to work with him and fill his prescriptions. Over time, he was able to build sufficient trust and confidence among these pharmacists to feel comfortable serving his patients. He then explained how, in the recent past, this relationship has transformed to further support his work saying:

> "So there are so many [pharmacists] near my area. These pharmacists knows…what I'm doing…so they are also cooperative. And not only that, they also give discount to my patients! They know that I'm doing charity work, they also provide some 10-15% percent discounts to all my patients, to see that they take medicines! So I'm thankful to them." (D8)

Patients too, for their part, establish relationships with pharmacists in their neighborhood, identifying those they can trust. P1 expressed how he prefers to purchase all his medications from the same pharmacist *"because [these] pharmacies… you're buying medicines from the same person. So he trusts [you]…He doesn't ask for a prescription. Like… you ask him directly [for] the tablets."*

Pharmacists dynamically negotiate their relationships with stakeholders as they seek to fulfill prescriptions, while working within the law. Multiple doctors and patients expressed that the regulations regarding prescription medications in India are not strictly enforced, and a product of the in-situ decision-making of the pharmacists. D4 explained:

> "Here in India, most of them are available over counter, honestly. There is no drug which is not given…only now for COVID, paracetamol is needing a prescription…otherwise any other [drug], the patient just goes…in the medical shop [and] they give." (D4)

COVID-related developments have introduced multiple tensions in these relationships. P6 explained how, as senior citizens, he and his wife were uncomfortable visiting their pharmacist, and chose to order their medicines from online pharmacies instead. The rise of online pharmacies and changing regulations on drugs due to the pandemic has affected patient-pharmacist dynamics. P4 attempted to purchase medications following a teleconsultation with a doctor, but was asked for a physical prescription. Recounting his experience, he said:

> "[The doctor] said 'okay, you know what? Make a change of this medicine'…I wrote it in a piece of paper, I went to the chemist, who said, 'this [is] a piece of paper…I'm not going to give it to you!' And then that's when I said, 'you know I'm a regular customer…Why are you saying things like this? I always come to you…If you don't believe me also, then what [do I do]?' (laughs). He's like, 'Sir, Government will ask us.' " (P4)

In sum, we have shown how trust-based relationships between doctors, patients, and pharmacists are being impacted by the changes introduced by the COVID-19 pandemic with online pharmacies and new Governmental regulations introducing strains on these relationships.

5.3.3 "The communication was between me and the doctor": Diminishing Roles of Support Staff in Consultations. The shift to teleconsultations has also resulted in changing roles and responsibilities for administrative and clinical support staff for doctors, and the caregivers of patients.

Administrative support staff typically managed the responsibilities of scheduling appointments, collecting fees, and otherwise interfacing between patients and doctors outside the consultation. With a shift to teleconsultations, their responsibilities are changing, or being made redundant, as most such work are being done through hospital portals or directly by the already-overburdened doctors. Similarly, clinical support staff like assistants who are present during consultations are seeing their roles diminished as well, as P4 recounted:

> "[In] an in-person consultations, [there] will probably be one of the doctors assistants... 'Bring the thermometer, bring the BP monitor,' and things like that. So one of the doctor's assistants are probably [there]... In teleconsulting, there's no such option that the doctor will have someone else... in the conversation." (P4)

Some of these in-consultation assisting roles fell on the patients' family members who were with them during their teleconsultations. P5 described how her daughter participated in her teleconsultation when she did not have sufficient mobility to move explaining that she *"couldn't move around much, so I couldn't place the camera properly. So [my daughter] held it for me, so that the doctor could see my movements, mobility, and all that."* She continued, explaining that her family members taking on such new responsibilities meant a change in their communication practices during consultations. P5 explained how her family members' involvement in her consultation changed due to a shift to teleconsultations saying:

> "While you're doing a e-consult, it's not like many people can talk or describe. It becomes very distracting then! It's better [if] the doctor and the patient only talk! If someone else also starts talking, the doctor gets distracted, and the video cannot cover everybody... So my husband and me, we decided I will talk, describe everything. Later, if he has any doubt, I would just let him sit and talk on his own. Not together." (P5)

In this section, we have shown how the human infrastructures comprising healthcare provision are being stressed in current circumstances, with responsibilities being reallocated or made redundant.

6 DISCUSSION

Our research investigated the uptake of telehealth in urban Indian contexts during the first six months of the COVID-19 pandemic. Telehealth had previously occupied a peripheral role in the Indian healthcare system, and we identified its adoption for continued care provision among people in response to forced mobility constraints. We presented the shifts in interpersonal relationships that facilitated, or were a result of, the uptake. In this section, we first detail the impacts of the transition on the stakeholders involved in healthcare in urban India. Then, with the understanding that some changes resulting from this short-term forced transition may continue to exist even in a post-COVID world, we offer recommendations and implications for telehealth systems design.

6.1 Changing Stakeholder Responsibilities due to COVID-19

Prior research in HCI has presented a case for studying the social and material interactions between stakeholders in healthcare systems[27] and the human infrastructuring work that supports them[17]. Subsequent works have highlighted the infrastructuring work of patients engaging with healthcare systems[30], and the network of intermediaries and frontline health workers ensuring last-mile care provision in-person[38, 39] and remotely[13]. Efforts to control the spread of COVID-19 gave rise to a unique opportunity to study the infrastructuring work of doctors and other stakeholders as they transitioned online.

Our findings indicated that doctors saw a shift in their priorities and practices as they transitioned to teleconsultations. In identifying the additional work that this transition entailed, our research also surfaced telehealth practices doctors had set up even prior to COVID-19. We found that some doctors made themselves available to their patients via phone or WhatsApp to provide non-diagnostic follow-up care. These consultations were mostly unpaid, and primarily served to ease logistical burdens (like travel) on their patients and to make more time for in-person consultations with other patients. Doing so, however, came with social and emotional burdens as they were mostly conducted from the doctors' homes and in their free time. These burdens

were only exacerbated by the forced transition, as remote consultations became more complex and time-consuming. For example, the doctors spent more time questioning the patient to understand symptoms and arrive at a diagnosis. They distributed consultations over time, requesting patients to send pictures and/or videos of any external symptoms for perusal before the actual consultation. All of these changes worked primarily to prevent breakdowns. Doctors' primary consideration seemed to have been returning to a system where they were most equipped to provide care and building trusting long-term relationships with their patients. Teleconsultations during COVID were considered a stop-gap without directly enacting long-term changes to relationship-building behaviors.

We found that for other stakeholders, patients in particular, this transition served as a window into what could be the future of their healthcare-seeking practices. Teleconsultations held an added value of logistical convenience: both in availing care from local practitioners within their city, as well as specialists or known practitioners outside. Further, the easy access to diagnostic care, either via aggregation platforms or WhatsApp, may have instigated a shift in perspective about consultations away from one that centered relationship- and rapport-building (e.g., family doctors) in patient-doctor interactions as evidenced by our findings. Prior work has identified how doctors' consultation practices are changing to accommodate internet-informed patients in a historically power-imbalanced interaction [8, 12]. With consultations themselves shifting online and patients' involvement in consultations increasing in the myriad ways described by our findings, we observed a shift towards patients becoming more active in their care. From the patients' vantage, the increased presence of individual doctors and aggregation platforms online could be shifting the perception towards healthcare, too, as an on-demand online service that further balances power dynamics between patients and doctors.

Finally, our study also surfaced the effects of this transition on other stakeholders who did not participate in our study, like pharmacists and doctors' assistants and administrative personnel (e.g., receptionists). As we found, pharmacists' work practices are in flux as governmental regulations are not keeping up with the adoption of telehealth and digital prescriptions. With prescriptions being largely and historically paper-based in the context of our study, the onus fell on pharmacists to assess validity of digital prescriptions and potential legal ramifications where no clear guidance existed. Further, our participants indicated in some instances that they encountered that administrative roles, like that of scheduling appointments and processing payments, were made redundant. Other roles, like that of doctors' assistants during consultations, were redistributed to the patients themselves or their family members/caregivers. A long-term adoption and mainstreaming of telehealth will need to contend with these changing responsibilities among stakeholders even as some are left behind by the technological advances.

6.2 Infrastructuring Telehealth for a Post-COVID World

In Star's writing on the Ethnography of Infrastructures [83], she presents that infrastructures are compiled over time with multiple incremental changes. When changed, they inherit the strengths of what existed previously and improve upon the weaknesses. This rings true for telehealth at this inflection point. Even though current teleconsultation practices are considered temporary, positive changes they brought about could become a permanent fixture of the Indian healthcare infrastructure. Logistical benefits like deciding when to visit doctors or having minor diagnostic consultations remotely, for example, could greatly benefit mobility-constrained people. In this section, we will present design implications and recommendations for future telehealth technologies in India based on the challenges we identified in our study.

6.2.1 Remote Diagnostic Care. Our findings identified different mechanisms doctors employed to diagnose and treat their patients remotely. Some doctors spent more time collecting patient history and description of symptoms from newer patients. They additionally had to vary consultation and communication approaches in order to most effectively communicate their diagnosis/prognosis with their patients. As many clinics and hospitals adopted ad hoc mechanisms to begin providing telehealth to their patients, they came at the expense of flexibility and customizability that each consultation needed, as we found. So far, these mechanisms were made possible by leveraging multiple different technologies together: phone calls, emails, WhatsApp (media sharing, audio/video calls), Zoom, online consultation portals, and mobile wallets. Such mechanisms were not only complicated, but also made implicit assumptions of the technological proficiency of their patients. Ideally, future telehealth systems would not put the burden of technological proficiency on the patients and depend on basic mobile phone literacy (phone calls, WhatsApp media and video calls, mobile wallets) to serve a broader audience not restricted to the technologically savvy. They further would allow for sufficient customizability of usage to best equip doctors to draw on their experience and communication skills to provide care to their patients.

6.2.2 Trust and Privacy in Patient-Doctor Relationships. We found that patients shared their health data with doctors in text and image form, over services like WhatsApp and email. Our probing into the privacy considerations for this form of data sharing surfaced that little thought was given to the technologies themselves used and the longevity and handling of the shared data. Implicit in this exchange was the trust that the doctors would handle such data carefully, with receiving care being more important than any privacy considerations. The only notable exception was when it came to information that patients themselves considered sensitive in nature, and took measures like "deleting for everyone" after a short period of time. Such practices burdened doctors with the responsibility of appropriately managing the shared health data during a consultation. Where in physical consultations doctors could either appropriately file away patients' records or return it to them without making copies, teleconsultations and the technologies facilitating them necessarily duplicated this data requiring explicit management as well as exposed this data to third party service providers. This practice complicated the boundaries between doctors' personal and professional lives on platforms like WhatsApp, as routine behaviors from one compromised the other. A path for future exploration and design, then, becomes one that considers shared health data ownership, and designs for short-term sharing of health data on teleconsultation platforms. In line with current designs of social media platforms, teleconsultation platforms could be designed to accommodate in-consultation image and video sharing that only exists outside the control of the owner (patient) for the duration of the call, meeting the doctors' needs while preserving the patients' control over their own data.

Our findings also shine light on the paucity of research in HCI on health data and its situated privacy considerations in India. Prior research seeking to understand conceptualization and definition of privacy in South Asia found that the focus was more on personal space than information flow and ownership [51], that there were tensions between individual privacy and shared device usage [2, 78], and among older populations a consequence of stewardship[63]. With no centralized and/or widely used digital health data standard as of yet, understanding of health data privacy remains nebulous. As teleconsultations become more widespread and health data flows more freely among the stakeholders involved, there is an acute need for problematizing and addressing health data privacy in the design of technologies that handle them.

6.2.3 Digital Payment Systems. With pre-COVID teleconsultations used primarily for logistical and short follow-up conversations, with the implicit guarantee of a future in-person consultation, there were no established payment mechanisms between patients and doctors. Now, however, as

teleconsultations are adopted to provide services in lieu of in-person consultations, these mechanisms have become a necessity. The conversation setting pricing expectations for consultations have become a source of awkwardness for doctors as our findings presented. We believe this stems from the tension arising by simultaneously considering consultations as empathetic caregiving as well as a paid, skilled service. Whereas in-person consultations carried prior expectations of payment for service, teleconsultations did not. Design solutions for digital payment systems might need to navigate this tension at least in the near term, as social norms differentiating diagnostic teleconsultations from follow-up or logistical one are established. One approach to incorporate this feature into the design of telehealth systems could involve mandatory pre-payment of consultation fees defined by doctors, with doctors given the ability to modify (including refund) fees after the consultation. Such an approach might allow the existing practices of unpaid informal follow-up conversations to co-exist alongside formal teleconsultations.

Finally, it is imperative to consider those who are not currently served by such advances in consultation practices. In addition to data ownership and privacy considerations, equity and inclusivity of healthcare remains a persistent concern. Research on telehealth has thus far focused on implementations in the Global South, with an unmet desire to extend existing, strained resources to regions that are more remote. Learning from past research in related settings [13], and our findings presented in this paper, we argue for further investigations into making healthcare infrastructures more equitable and inclusive. This would involve attempting to cater not only to middle-income and socioeconomically disadvantaged families, who have been significantly harder hit during the pandemic, but also to those who are left behind by technology advances that require high technology literacy and proficiency. Even as we prepare for a post-COVID world where telehealth is more routine and accessible, we must also pay attention to the ways in which the design of these infrastructures is likely to support and promote fair and just healthcare practices (or not). In doing so, we must draw special attention to the interpersonal factors that our findings found to be assets in the infrastructuring process.

6.3 Limitations and Future Work

Our interest in examining demographic contexts that had actively embraced telehealth may also be viewed as a limitation of our study. Responses to our survey came predominantly from urban parts of India, which is where telehealth solutions have also been more widely engaged since the onset of the pandemic. We hope that future work will investigate the potential for these solutions to impact relatively resource-poor contexts as well, engaging research participants who come from marginal backgrounds.

7 CONCLUSION

Telehealth technologies have predominantly provided peripheral support to healthcare infrastructures in the past. Their roles are changing as the COVID-19 pandemic is centering them as crucial means of providing non-COVID-19, non-emergent care. In this paper, we presented a qualitative analysis of 181 survey responses and 18 interviews with doctors and patients who live and work in urban India, to reveal the infrastructuring work that has supported this transition. We provided an analysis of the technology infrastructures in place and being created, the in-consultation infrastructuring work required of doctors and patients to adapt to teleconsultations, and the shifting dynamics of the human infrastructures that enable healthcare. We presented implications for the design of telehealth infrastructures based on these findings, arguing also that teleconsultations could potentially present an important path forward to inclusive and equitable care in the future.

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