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Entangled Amid Misaligned Seams: Limitations to Technology-Mediated Care for Repairing Infrastructural Breakdowns in a Youth Empowerment Program

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The COVID-19 pandemic broke down the human infrastructure of many community-based programs, disrupting in-person care services for low-resourced families. Yet, minimal work has explored how actors repair these breakdowns and how other infrastructures may interfere with repairs in such contexts. Interviewing adolescents and adults affiliated with a youth empowerment program, we used the pandemic to examine how a human infrastructure that previously facilitated a sense of community broke down and how members attempted to repair this infrastructure. While organized activities, resources, and interpersonal interactions aligned to facilitate in-person care that established a sense of community, incorporating information and communication technologies to align a sociotechnical infrastructure during social restrictions could not overcome multiple constraints imposed by other infrastructures that limited this sense of community. We discuss limitations to care and aligning together multiple disjoint infrastructures, calling for CSCW researchers to critically consider asset-based design as a methodology that might help sustain a community's well-being.

CCS Concepts: • **Human-centered computing** → **Empirical studies in collaborative and social computing**; *Empirical studies in HCI*; *HCI theory, concepts and models*; **Collaborative and social computing theory, concepts and paradigms**.

Additional Key Words and Phrases: social support, assets, multi-infrastructural torque, heterogeneity, heterogeneous infrastructures, techno-solutionism, seams, COVID-19, parochialism, politics of care

1 Introduction

Low-socioeconomic status (low-SES) and racially minoritized youth are more likely than their affluent and majority counterparts to experience threats to their health and well-being [97]. More recently, socioeconomic instability from the COVID-19 pandemic has further exacerbated these health disparities as minoritized youth are more likely to experience the negative health consequences of housing evictions, job layoffs, social isolation, and other social determinants of health [2, 55, 71]. In

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light of these disparities, public health experts have called for investments in infrastructures like community-based programs and social services to better care for those most vulnerable to future crises [2, 60].

The infrastructure of youth empowerment programs (YEPs) is critical for sustaining the well-being of youth in low-SES communities. For this study, we define *infrastructure* as the assemblage of actors, activities, and artifacts to accomplish goals [88]. Infrastructure includes social and technical components with the social, organizational, and human aspects of infrastructure referred to as *human infrastructure* [52]. In the case of YEPs, its primarily human infrastructure facilitates informational and educational resources that support learning [7, 27, 38], scaffold civic engagement opportunities that empower youth to combat systemic inequities [5, 16, 27, 48], and provide emotionally supportive relationships [13, 28, 38]. This infrastructure provides youth with a wealth of resources that support their well-being. By studying YEPs and their infrastructure, researchers can yield crucial insights that inform how technologies might strengthen similar infrastructures to mitigate health disparities and better care for minoritized youth and their families.

Drawing upon notions of care [21, 25, 66], we understand care to be an affective commitment expressed through routine practices that sustain the well-being of people and 'things.' Care includes labor and technology-mediated work [23, 103] that builds, maintains, and repairs infrastructure (i.e., *infrastructuring*) [22, 23, 53, 84] to meet people's needs. However, caring for others in one context may differ in another. In YEPs, those cared for often desire a sense of community, with previous research suggesting that care practices in other community-based programs exist as assets (i.e., the collective and individual resources of a community for sustaining its well-being [49]) for facilitating this feeling [22, 44, 82] and that a sense of community is positively associated with one's social and emotional well-being [90]. Therefore, we use the theoretical concepts of care and a sense of community to analyze the technology-mediated and infrastructuring practices of a YEP to understand particular forms of care work that builds and maintains a sense of community. Furthermore, we examine how care can function as an asset when infrastructural breakdowns occur but the possible limitations of infrastructural repair.

Prior work examining YEPs has investigated the interpersonal interactions among human actors in these programs (e.g., [27, 38]). Minimal work has expanded our understanding of the technology-mediated and infrastructuring practices that care for youth and their families in this context, specifically when repairing breakdowns in human infrastructure and the potential interference of other infrastructures like the government, economy, or telecommunications (e.g., [11, 98]) that can disrupt these repairs. In the wake of social isolation, job layoffs, and disruptions in education from COVID-19 [2, 55, 71], we stress the importance of studying breakdowns in infrastructure and the sociotechnical practices found therein to inform our understanding of how information and communication technologies (ICTs) can facilitate or fall short of building community. By examining care as an asset in YEPs, we might better advocate for design methodologies that equitably support low-SES communities during social distancing crises and design for more socially just futures.

Observing a research gap, we aimed to study the arrangement of a human infrastructure and its repair that enabled youth and parents to experience a sense of community. We used the COVID-19 pandemic as an event that caused breakdowns and tensions in a YEP's human infrastructure and made analytically visible the infrastructural assemblage that provided care for families [53, 88]. This context enabled us to examine the alignment of actors, resources, and activities that established a sense of community before COVID-19, the breakdowns and constraints of multiple infrastructures during a crisis that interfered with a sense of community, and attempts to align a sociotechnical infrastructure when repairing breakdowns. For our work, we partnered with a YEP within a predominantly low-SES neighborhood in the Southern United States to answer the following research questions:

- **RQ1**: How is the YEP's human infrastructure arranged to provide care for low-SES families and build a sense of community?
- **RQ2**: How is the YEP's human infrastructure repaired when breakdowns disrupt care that establishes and maintains a sense of community?
- **RQ3**: How do the constraints of other infrastructures interfere with the infrastructural repairs of a YEP that aimed to maintain a sense of community amid disruptions to care?

Through semi-structured interviews with 13 individuals (eight adults and five youth) affiliated with the YEP, we find that the arrangement of various personnel, resources, and interpersonal interactions provided care for youth and their parents (i.e., care recipients). By participating in this caring assemblage, recipients experienced a sense of community. Yet, when YEP staff (i.e., caregivers) repaired infrastructural breakdowns by incorporating ICTs (e.g., Zoom and SMS) to maintain a sense of community, their repairs could not resolve the constraints introduced by *heterogeneous infrastructures* [51], that is, other infrastructures that non-coherently became entangled with the YEP and disrupted recipients' online participation. We engage the concepts of *infrastructural seams* and *multi-infrastructural torque* [96] to unpack how, despite caregivers' repairs to the human infrastructure, the constraints imposed upon care recipients by heterogeneous infrastructures proved too difficult to disentangle. Observing the limitations of ICTs and care as assets to facilitate a sense of community, we reflect upon techno-solutionist critiques in HCI, CSCW, and design and call for design researchers to critically consider an asset-based approach when designing sociotechnical systems to work around infrastructural constraints.

Building upon literature in care [21, 64, 94, 95], infrastructure [53, 88, 96], sense of community [62], and youth empowerment [7, 38], our research contributes empirical knowledge for how the human infrastructure of a YEP provides care, how care as an asset establishes and maintains a sense of community, and how incorporating technological solutions (i.e., ICTs) with care may fail to repair infrastructural breakdowns from ongoing physical separation. Specifically, we highlight the challenge of repairing breakdowns when heterogeneous infrastructures entangle care recipients from receiving proper care. As systemic inequities are increasingly studied within CSCW, insights into how heterogeneous infrastructures can interfere with community well-being can further our understanding of how marginalized communities become systematically excluded, the limitations of technological solutions for overcoming systemic barriers, and the complexity of resolving inequities amid infrastructural constraints. Our findings can spur further work on using heterogeneous infrastructure and infrastructuring as lenses to investigate matters of social justice in other marginalized contexts within CSCW.

As low-SES neighborhoods continue to lack resources that threaten their health and well-being, there is also a pressing need to thoughtfully consider how to design and implement sociotechnical systems to combat these systemic issues and sustainably care for these communities. To that end, our analysis of this study site also contributes methodological reflections on an assets-based approach to design that may help sustain the well-being of marginalized communities. These reflections build upon ongoing work on assets-based design [101, 102, 105] and techno-solutionist critiques of design [19, 24, 33, 86], providing a rationale for why assets-based design may equitably sustain a community's well-being even when a community faces a multiplicity of infrastructural constraints. Yet, we also express skepticism towards such an approach, understanding that infrastructures have historically and will likely continue to systematically exclude those at the margins. We call for design researchers focused on sustainability, equity, and community-based research to further consider, adopt, and evaluate assets-based design as they collaborate with similar communities in their research contexts.

2 Related Work

2.1 The (Human) Infrastructure of Youth Empowerment Programs

Understanding infrastructure as a relational concept, CSCW scholars, such as Star and Ruhleder [88], have historically studied the assemblage of human actors, activities, and artifacts and their alignment to facilitate work, tasks, and goals [53]. Although the concept of infrastructure traditionally brings to mind notions of bridges, electrical grids, or the internet, researchers like Lee et al. have also proposed the concept of *human infrastructure*, referring to the "[social] arrangements of organizations and actors that must be brought into alignment for work to be accomplished" [52, p. 484]. Human infrastructure draws attention to the interactions, resources, and organized practices of human actors that are brought together into a coherent and stable whole.

Human infrastructures, like physical and technical infrastructures, can break down, fall into disrepair, and become *misaligned*: no longer concordantly structured to support the work that initially brought the assemblage together. Whereas physical and technical infrastructures are less adaptable to large-scale disruptions, human infrastructure is often dynamic and can be flexibly re-arranged [23, 52, 85, 92]. Nonetheless, drastic re-arrangements and adaptations can bring tensions and frustrations to actors as they orient themselves to these changes [23, 92]. Using human infrastructure as a lens to analyze the organizational practices and social arrangements of YEPs during the COVID-19 pandemic, we aim to elucidate how the human infrastructure of a YEP breaks down as a result of large-scale socioeconomic changes, the workarounds to re-align infrastructure, and the degree to which workarounds could once again provide care.

Although CSCW researchers have richly studied infrastructures in contexts like healthcare [31, 92], crisis informatics [23, 85, 98], and community-based work [22, 46], YEPs are understudied as local sites for supporting youth's well-being and facilitating community development. Yet, the infrastructure of YEPs is critical for facilitating work that supports the well-being of youth and members of the local neighborhood [5, 13, 27, 28, 38, 48]. Building upon prior CSCW research on infrastructure and community development research on YEPs, we examine the arrangement of actors, resources, and activities that provided care for low-SES families in a YEP, the breakdown of the YEP's human infrastructure during a crisis that caused community separation, and the attempts by human actors to transition to a sociotechnical infrastructure by relying on ICTs to provide technology-mediated care.

2.2 Infrastructuring Amid the Seams of Heterogeneous Infrastructures

Building on infrastructure, the term *infrastructuring* refers to the process of aligning activities, artifacts, and actors to overcome breakdowns and accomplish specific tasks and goals [42, 75]. Infrastructuring shifts the analytical focus away from the relational form and makeup of infrastructure at one point in time and towards the ongoing work of integrating actors, artifacts, and activities when building, maintaining, or repairing an infrastructure. This framing allows CSCW researchers to analyze the process of artifacts being introduced, adapted, and embedded by actors into their existing work practices [53, 57, 75]. Infrastructuring is most salient after disruptions when human actors can no longer accomplish routine work and have to adapt [57, 84, 88]. In our study, we use infrastructuring to analyze an ongoing process by which actors incorporate ICTs to transition from a human infrastructure to a sociotechnical one, expanding the analytical focus to encompass the alignment and re-alignment of infrastructure as social disruption occurs.

Infrastructuring also attends to the constraints and provisions of heterogeneous infrastructures that impose or support actors' work. Taking John Law's concept of heterogeneity [51] and applying it to infrastructure, Janet Vertesi [96] explained that when multiple infrastructures are needed to accomplish work, disparate infrastructures non-coherently come together in a patchy and

non-uniform fashion, requiring human actors in this context to first align them together into a functional and coherent whole. Unlike the concept of infrastructure, where the analytical focus is on a single infrastructure and its breakdowns, infrastructuring can expand the analysis to include heterogeneous infrastructures coming together, the constraints and provisions to actors' work as heterogeneous infrastructures converge, and the process of pulling these infrastructures together into local alignment. Using the language of *infrastructural seams* to describe the resulting gaps and overlaps of heterogeneous infrastructures non-uniformly coming together, Vertesi [96] also indicated that actors may become caught and entangled among conflicting heterogeneous seams, incapacitating them from participating in work [6, 87]. Building upon this point, we suggest that actors, in some cases, cannot infrastructure their way out of conflicting seams, excluding their participation in critical infrastructures like those of YEPs that support their well-being.

Empirical work within CSCW has previously used infrastructuring to examine the process of integrating and adapting resources to repair existing infrastructures, create new ones, or work around them in contexts such as healthcare [31, 46], crisis recovery [23, 84], and public service programs [22, 36, 98]. When existing infrastructures break down, actors adapt, changing work practices and appropriating artifacts to accomplish work. For example, Bryan Semaan's [84, 85] accounts of university students integrating ICTs like Facebook to continue their education amid wartime highlight the infrastructuring of new sociotechnical arrangements to maintain daily routines when infrastructures no longer supported in-person learning. Similarly, Møller et al.'s [36] and Gui and Chen's [31] work both attend to the tensions of infrastructuring, elucidating the process by which individuals need to navigate through institutional barriers and organizational failures by pulling health data, social connections, and routines into local alignment to receive the necessary care services. While infrastructuring can alleviate needs and create a sense of empowerment momentarily, such work may inadequately support marginalized groups in the long term, especially in contexts where infrastructures exclude and work against them [58, 61]. Importantly, this body of work suggests that stitching, repairing, and bridging infrastructural gaps and overlaps is ongoing, laborious, and even frustrating because alignment is often fleeting, requiring constant infrastructuring to achieve alignment again [96]. Although we detail a process of caregivers adapting ICTs to repair a YEP's infrastructural breakdowns, these repairs fell short of aligning the seams of heterogeneous infrastructures so that recipients could seamlessly participate online with community.

2.3 Understanding the Sociomaterial & Political Implications of Care

Initial conceptions of care described it as an affect that manifests in direct relational interactions between two human actors—a caregiver and care recipient [66]. Understanding that care also includes the way in which humans collectively engage with the world, Bernice Fischer and Joan Tronto broadened care to include "everything that we [as a species] do to maintain, continue, and repair our 'world' so that we can live in it as well as possible" [25, p. 34]. Elaborating upon this definition, Tronto [94] describes care as an ongoing four-step process that is motivated by ethical values of *attentiveness*: understanding the needs of others, *responsibility*: taking on the burden of meeting these needs, *competence*: being capable of meeting these needs, and *responsiveness*: evaluating the adequacy of care given. Further developing care as a political theory in her later work, Tronto [95] added the ethico-political value of *solidarity*, arguing that all citizens have a collective and equal responsibility to care for each other and the world. Care recipients can be encouraged to develop these ethical qualities by practicing to care alongside caregivers, becoming caregivers themselves [66]. Care not only exists in the dyadic relationship between humans caring for each other but also in their collective responsibility to maintain societal well-being.

STS scholars like Maria Puig de la Bellacasa [21] have also argued that care is enmeshed within the relational assemblage of humans, artifacts, and activities (i.e., infrastructure) with non-human entities contributing to care processes that sustain well-being. Drawing upon this notion of care, CSCW researchers have studied caring interactions among human and non-human actors, including the human labor involved in precariously repairing infrastructures [17, 23, 46, 84] and the role of artifacts within caring assemblages for facilitating and shaping care work [44, 45, 103]. Most applicable to our work, studies in CSCW have observed that caregivers enact routine care through artifacts, whether answering emails to maintain the operations of non-profit organizations [32], collecting housing data to sustain a community's well-being [63], or emotionally laboring over social media to help family and friends in need during an ongoing crisis [23]. Building upon this socio-material aspect of care [103], we elucidate how caregivers of a YEP attempted to use ICTs with minimal success to repair infrastructural breakdowns and mediate routine care to continue supporting the well-being of their care recipients when gathering in person could not be maintained.

Despite studies describing care as an asset for sustaining the well-being of low-resourced communities [22, 44, 82], STS scholars and care feminists also caution against these feel-good narratives of care, indicating the political dangers inherent within caregiving [94, 95] and the non-innocence of care when enmeshed in political systems [21, 64]. Positing that caregivers would likely prioritize whom they care for, Tronto [94, 95] warned of a *parochialism* within care, suggesting that caregiving can become privatized and self-interested if caring responsibilities are not distributed democratically. Care feminists and STS scholars like Michelle Murphy [64] and Puig de la Bellacasa [21] have built on these concerns and warned against simplistic and romanticized notions of care, citing care's historical entanglements with colonial, neoliberal, and racist systems of power that have exploited, appropriated, and disrupted care work. Unpacking the politics of care, CSCW and HCI researchers have highlighted the unequal burden of technology-mediated caregiving amid infrastructures that have failed to care for those in need [23], the unintended reproduction of racialized hierarchies when caring for those historically marginalized [50], and the complexities of infrastructuring care amid systems that devalue care [43]. Across this body of work, these matters of care [21] are fraught with political ideologies that reify asymmetrical power relations within caregiving. Our work, too, adopts a political lens to examine the limitations of care as an asset to encourage YEP participation when heterogeneous infrastructures exclude recipients from participating and receiving care.

2.4 Building & Maintaining a Sense of Community as a Matter of Care

Community psychologists McMillan and Chavis [62] defined a *sense of community* as a feeling of belonging with others and a belief that community members are committed to each other's well-being. They theorize that a sense of community has four defining features:

- *Membership*: a feeling that one identifies with and is accepted by others in a social group
- *Influence*: a sense that one's presence, opinions, and actions are valued within a group and that the group is valued by its members
- *Integration & Fulfillment of Needs*: an expectation that one's needs will be met by members
- *Shared Emotional Connection*: a sense that members can relate with each other due to shared histories, experiences, interactions and/or identities

A sense of community is formed and maintained through intimacy, safety, and trust among community members [76, 79], personal investments that make membership costly and meaningful [37, 81], needs being consistently met by other members [62, 78], and frequent interpersonal interactions among community members [40, 62, 74]. While more recent literature has critiqued the validity and reliability of sense of community measurements [15, 73] and discussed differences between online and offline sense of community [1, 4, 67, 68], our use of this theoretical concept is not

to assess its psychometric properties nor to evaluate the efficacy of ICTs. Instead, we leverage this concept to focus on particular forms of care in the YEP, foregrounding care that builds and maintains a sense of community. By foregrounding care, we also emphasize the precarity of infrastructural repairs and the politics of care work, highlighting the seams of heterogeneous infrastructures that hinder recipients from experiencing a sense of community amid infrastructural repair.

Studies in HCI and CSCW have also observed care's capacity to create and maintain a sense of community when actors labor to care for others. Dillahunt et al.'s [22] empirical work of a community-based mentorship program highlights the care work of mentors to offer flexible social support that fosters familiarity and trust among its care recipients, establishing a sense of community among actors through *the fulfillment of needs*. However, a sense of community develops insofar that actors are willing to *influence* each other and agree on a set of shared values. In the case of Karusala et al.'s [44] study of an afterschool program, conflicting values on how to care for students' education created tensions between program staff and parents that interfered with care collaboration. Although Karusala et al. were hopeful of ICTs' role in alleviating tensions between program staff and parents to build a sense of community, Sackitey et al. [82] observed that the use of technology for maintaining *shared emotional connections* and facilitating a sense of community among church members during COVID-19 could not replace face-to-face interactions, even when values among church members and technologies aligned. With few studies in CSCW and HCI that discuss the situatedness of care to build a sense of community, we examine how care fosters this sense within a YEP and how misaligned infrastructural seams disrupt this feeling.

3 Methods

We provide an overview of our research partnership with the YEP and describe our recruitment, data collection, and analysis methods in the subsequent sections. Using a qualitative approach, we conducted semi-structured interviews with youth in these programs, parents of youth, adult staff, and a community partner. Interviews provided multiple perspectives of those involved in this organization to understand infrastructures that enabled and inhibited routine care.

3.1 Study Site Overview

Before the COVID-19 pandemic, the YEP in this study had about 15–25 staff that cared for approximately 50–100 children and adolescents in a predominantly low-SES neighborhood in the Southern United States. At the time of our study, children between 5 and 11 years old could join an afterschool program where they participated in academic tutoring and other enrichment activities. When individuals became 14 years old, they could join the organization's community engagement program. In this program, adolescents would partner with adult staff to organize community events, manage a communal space for local neighbors to gather, and host civic meetings with local government. YEP staff also provided informational and financial resources for the youth's parents, collaborating with them to care for their children. These resources included rental assistance, especially during COVID-19, or seminars that would educate parents on topics like parenting or nutrition.

However, due to economic and psychosocial stressors caused by the pandemic, a substantial number of families no longer attended the YEP as they had to dedicate time and resources to care for themselves. In turn, the YEP experienced employee attrition, scaled down its operations, and transitioned its in-person programs and communication online, using ICTs (e.g., videoconferencing tools, phone calls, and SMS) to maintain social connections. While we did not attend organizational meetings or directly observe online interactions among YEP members at the pandemic's onset, the first author did volunteer online and in person for approximately 30 hours, working with the community engagement program near the end of the pandemic after the data collection period.

Observations from volunteering are not used as data for the paper's findings but provide added context on organizational changes and interpersonal interactions that inform our data analysis.

3.2 Recruitment

We recruited participants with the YEP through four different methods. First, we asked the YEP's executive director to advertise our study via community newsletters. Second, the executive director directly connected us to parents, staff, and community partners affiliated with the program. Third, with permission from the YEP, the first author attended online meetings and activities to directly advertise the study to youth in the community engagement program. Fourth, we conducted snowball sampling by asking participants to share the study with others in the YEP. Potential participants contacted the first author via text or email or willingly gave the research team their contact information for us to follow up with them and begin the consent or assent process.

Our institution's IRB approved this study, which involved a consent and assent procedure for adults and minors. If a minor (i.e., <18 years old) expressed interest in participating, we electronically sent them two forms: a parental permission form and an assent form for a parent/guardian and minor to read and sign. Similarly, if an adult expressed interest in participating, we electronically sent a consent form for them to read and sign. To ensure that participants had read through the document before signing, we asked them to summarize the purpose of the study. Additionally, to mitigate coercion from the research team or other authority figures (e.g., parents, guardians, or YEP staff), we explicitly asked participants if they were voluntarily participating in the study and reminded them that they could end the study at any time before starting the study procedure.

3.3 Study Procedure & Design

For the study, we developed two semi-structured interview protocols: one for youth and another for adults. Both protocols asked participants about their lived experiences before and during the COVID-19 pandemic, their relationships with others—especially YEP members—throughout this period, and their use of ICTs to share personal matters. Whereas questions for youth focused on the social support they received, questions for adults focused on the support they gave to youth.

Interviews were conducted one-on-one from February to May 2021 through video or phone calls and lasted between 50 and 70 minutes. We audio-recorded and transcribed all interviews with permission from our participants. To enrich the quality of interviews, we assigned youth a writing activity before or during the interview. We asked our participants to reflect for 10 minutes about their experiences living in their neighborhood and then write a love or break-up letter to their community. Drawing inspiration from design toolkits [65, 99], we hoped that a creative activity would encourage youth to share vulnerably during the interview and elicit thoughts about their neighborhood that we could probe.

We asked participants to complete a demographic survey at the end of the interview. The survey collected participants' race and ethnicity, socioeconomic status, technology usage, and other basic demographic information. Questions that request household income commonly indicate a family's socioeconomic status; however, youth may not know this information. Instead, we used the first question of the MacArthur Scale of Subjective Status–Youth Version [29] to assess youth's socioeconomic status. The question first shows a picture of a ladder with 10 rungs and then asks the respondents to place their family on the ladder based on their family's income, job, education, and social status. Lower rungs represent low SES and vice versa. We compensated participants with an Amazon or Walmart gift card for their time, giving $15 to minors and $25 to adults.

Throughout the data collection process, the research team discussed and reflected upon the information gathered from each interview and used Malterud et al.'s [59] *information power* model to assess when to stop conducting interviews. According to this model, the following considerations

can guide researchers in determining whether smaller sample sizes can attain sufficient information power:

(1) The scope of the *study aims* is narrow
(2) The characteristics of the *sample* are highly relevant to the study aims
(3) The quality of *interviews* is rich in detail and in-depth
(4) Multiple *theories* are used to inform the research project
(5) The *analysis* focuses on the details of individual cases and not on cross-comparisons

While **(1)** our research aims were moderately broad, focusing on community-building practices and the breakdowns of a human infrastructure during a specific period of social disruption, **(2)** our interviews included a diverse and highly relevant array of stakeholders (i.e., staff, adults, and youth), who all were involved in this human infrastructure and provided **(3)** rich insights into the care practices of YEP members. Given these characteristics of our work, along with **(4)** our use of multiple theories to scaffold our data into an **(5)** in-depth case analysis of one relatively small organization, we reasoned that sufficient information power could be attained with a smaller sample size. As such, we stopped at 13 participant interviews, which—accompanied by in-person observations—should have provided enough information power to answer our research questions. This number also aligned with prior sample size assessments needed for qualitative findings [30, 34].

3.4 Participants

We interviewed a total of 13 participants: five youth (Y01-Y05) and eight adults, including three parents (P01–P03), four program staff (S01–S04), and one community partner (C01). One participant (Y02) did not answer the demographic survey, which the following descriptive statistics reflect. Youth ranged from 16 to 19 years old ($M = 17.25$), while adults ranged from 21 to 58 ($M = 37.13$). Of those we recruited, 11 self-described as 'Woman' and one as 'Man.' For youth, three self-identified as 'Black/African American' and one as 'Hispanic/Latine'; for parents, all three self-identified as 'Black/African American'; and for the staff and community partner, three self-identified as 'Black/African American,' one as 'Hispanic/Latine,' and one as 'White/Caucasian.' All youth (Y01-Y05) and parents (P01-P03) self-reported themselves as low-SES. Table 1 summarizes their role within the organization and lists pseudonyms used throughout the rest of the paper. Because of the YEP's size, we do not provide individual demographic details to retain participant anonymity.

3.5 Qualitative Data Analysis

For our qualitative analysis, we used Braun and Clarke's method of reflexive thematic analysis [9] to conduct two rounds of analysis of the interview data. Adopting a critical realist ontology and contextualist epistemology for our study, we recognize the existence of a singular reality but that truth and knowledge of that reality is subjective, partial, and situated, co-constructed by the lived experiences of our participants and subjective interpretation of the research team [9]. To be rigorous in our analysis and consistent in our ontological and epistemological commitments, the first author did not use coding reliability or validation methods like consensus coding, inter-rater reliability, or member checking to assess coding quality and minimize researcher bias. He instead reflected on his social position, experiences, and values that might inform his decision-making throughout the project and met regularly with the research team to reflect on the coding process and discuss possible themes constructed from the data. The first author used reflections and discussions with others to refine themes and add depth to the analysis.

During our first analysis, the first author inductively coded the interview data while familiarizing himself with research literature regarding *social support*, *computer-mediated communication*, and

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[1]Names of participants used throughout the paper are pseudonyms and do not reflect their real names.

Care Role	Name[1]	YEP Affiliation	Participant ID
Care Recipients	Maya	Youth	Y01
	Sasha	Youth	Y02
	Daniella	Youth	Y03
	Layla	Youth	Y04
	Olivia	Youth	Y05
	Elizabeth	Parent	P01
	Camila	Parent	P02
	Janet	Parent	P03
Caregivers	Brianna	Program Staff	S01
	Anthony	Program Staff	S02
	Kathy	Program Staff	S03
	Debra	Program Staff	S04
	Annie	Community Partner	C01

Table 1. Care Role & YEP Affiliation of Study Participants

care ethics. As the first author continued to familiarize himself with the interview data and created initial codes, the author generated themes around the process of relationship building within YEPs, social support that youth received from the YEP, the social effects of crises (i.e., COVID-19), and the breakdowns in computer-mediated communication that occurred during these stressors. However, from discussions with the research team and feedback from other researchers, the first author felt that the generated themes insufficiently explained why youth and parents felt alienated and distant from their community during the pandemic, even when YEP members used ICTs. Conducting a second analysis, the first author re-coded the interview data deductively, utilizing literature on *infrastructure*, *politics of care*, and *sense of community* as theories to make better sense of the data. Re-analyzing the data, the first author re-constructed new themes that sufficiently encompassed and richly explained phenomena he had observed, which we describe in our findings.

Findings from our analysis are structured to emphasize specific care practices facilitated by the YEP's infrastructure that built, maintained, or repaired a sense of community. We do not presume that our findings encompass all care practices but only include those made analytically visible from disruptions caused by the COVID-19 pandemic and are perceived by our participants as having meaningfully contributed, at one point, towards their sense of community. The situatedness of our findings also means that limitations, constraints, and breakdowns in infrastructures that interfered with YEP participation could have occurred elsewhere or in the same places before COVID-19; however, these breakdowns and constraints were not significant enough to interrupt routine care and a sense of community. Therefore, we use COVID-19 and a sense of community as analytical tools for which we, as researchers, can focus on examining the significance of routine care, understanding where and how heterogeneous infrastructures interfere with this care, and analyzing the process of repairing a YEP's infrastructure.

3.6 Reflexivity Statement

Embracing our subjectivity within reflexive thematic analysis [9], we self-disclose and reflect upon parts of our identities and experiences that have shaped our research and analysis. Studying low-SES youth and families, we report on our socioeconomic statuses and our experiences with youth. Most of our research team lived in middle-class or upper-middle-class households, while one author

grew up in a working-class family. All authors currently hold college degrees and live comfortably within their means. In addition, all authors have experience caring for youth through a mix of volunteer work in youth-focused programs (e.g., churches, advisory boards, and STEM education programs), research that supports youth, and child-rearing. The first author, who led data collection and analysis, has previously volunteered in several youth programs, forming relationships and working with low-SES youth. He has also served at churches that focus on mentoring college-aged youth. Although this study did not explicitly focus on matters of race, we also disclose our racial and ethnic identities, recognizing that matters of race and low SES can intersect, as evident in our participants' racial and socioeconomic composition. Three authors self-identify as White, one author identifies as Black, and the first author identifies as Chinese American.

With this constellation of identities and experiences, we recognize that our worldviews enhanced and limited our research. Having a wealth of experiences caring for youth across multiple authors, we could empathize with and understand youth's coming-of-age experiences and behaviors that subsequently guided our interactions with them during interviews. However, our limited experiences living in low-SES conditions may have hindered us from fully comprehending the mental, emotional, and financial burdens that come with crises like the COVID-19 pandemic. With a majority of our team living in a social system that privileges whiteness, our experiences may also have led us to interpret the data in a way that missed the nuances of racial inequities that intersect with low-SES conditions during the pandemic. Recognizing that our identities and experiences both limited and enhanced our understanding of youth in low-SES and racially minoritized groups during data collection and analysis, we present our findings from this epistemological standpoint.

4 Findings

Throughout our interviews, care persisted throughout the YEP's infrastructure, functioning as an asset for facilitating a sense of community for low-SES families. From the human infrastructure that routinely supported the well-being of families to the reliance on ICTs during the COVID-19 pandemic that aligned a sociotechnical infrastructure to repair breakdowns, the arrangement and infrastructuring of various activities, artifacts, and actors provided care. Families could receive care and experience a sense of community by participating in the in-person interactions and activities facilitated by the human infrastructure. Yet, despite caregivers incorporating ICTs to mediate care and maintain a sense of community when care recipients could no longer meet in person, constraints imposed by other infrastructures inhibited recipients from seamlessly participating online and receiving care from the sociotechnical infrastructure.

4.1 The Human Infrastructure of the YEP that Facilitates a Sense of Community

Parents in the neighborhood have historically lacked the financial means to enroll their children in tutoring or have access to other resources to support child development. Recognizing these needs, YEP staff organized various resources, programs, and services that provided care for these families. These included free educational seminars that supported parents' child-rearing, after-school curricula that developed youth's life skills, and fun social activities that encouraged social development. As the assemblage of these activities, resources, interactions, and actors aligned, this human infrastructure also provided care that established a sense of community, creating vulnerable moments that established *shared emotional connections*, facilitating support that met recipients' *needs and integrated* them into the YEP, *influencing* recipients to become caregivers, and structuring a safe environment for recipients to feel valued as YEP *members*.

4.1.1 Sharing Vulnerably to Establish Shared Emotional Connections. Participating in YEP activities slowly opened youth to share their life struggles with peers and adults and receive care that

established shared emotional connections. For example, Layla (Y04)—a member of the community engagement program—initially hesitated to interact with others in the program. Yet, by engaging in an array of social bonding activities with YEP staff and peers during an annual camping trip, Layla found herself warming up to them, even sharing a vulnerable experience with a peer:

> *"... [During camp] we would wake up... and just do bonding activities... [A]t the end... we would do a campfire, and everybody would tell something... really personal... But it's like after you form[ed]... the friendships at the camp as you were getting to know that person, it was really easy to talk to them. And I talked about how I was in a lot of foster care, some of the things that me and my family went through. One of my friends that I was talking to... she listened, didn't really interrupt, didn't judge..."* (Layla, Y04).

Here, Layla's participation in social bonding activities helped familiarize herself with other YEP members. As she participated in these activities, interacted with others, became comfortable talking with those around her, and formed relationships with them, she willingly shared a personal matter with a peer who empathized with and listened to her struggle. As a byproduct of participating in the YEP, care recipients may progressively feel comfortable enough with others to share vulnerably, opening themselves up for caregivers to attend to their emotions and care for them at that moment.

With participation in YEP activities building familiarity and culminating in care recipients becoming emotionally vulnerable, caregivers may relate to personal struggles and establish a shared emotional connection during these opportune moments. Paralleling Layla's account, Daniella (Y03), another adolescent in the YEP, recounted her experience at the campfire event during YEP's annual camping trip and the emotional connection she formed with a peer over a shared experience:

> *"... [S]he said that it was really hard for her growing up because she would be moving from place to place... It would be hard for her to focus in school... because of the situation going on at home... I relate[d] to her because I was moving around a lot... I had a lot of situations going on at home and it was messing with how I would focus in school... We've been friends since... we have a very tight bond"* (Daniella, Y03).

When participating in a YEP activity that encouraged vulnerability, one of Daniella's peers shared her struggles with Daniella. Listening to her share, Daniella related to her peer's life experiences, forming a deep relational bond. For youth, participating in the YEP creates opportunities to interact with their peers, become familiar with them, and create moments of vulnerability where youth connect over similar life experiences. These similarities form shared emotional connections that scaffold a sense of community. As such, routine participation in activities facilitated by the human infrastructure afforded opportune moments for YEP members to form caring relationships, emotionally connect, and build a sense of community.

4.1.2 Receiving Support to Establish Integration & Fulfillment of Needs. As families participated in the YEP, youth and parents trusted that the staff would reliably fulfill their needs. Participating in various services and programs embedded in the YEP's human infrastructure, care recipients perceived staff as capably supporting them. Youth, such as Daniella (Y03), trusted that YEP staff would meet their requests for help:

> *"I built very good relationships with all of the [YEP] adults... If I ever need somebody to talk to... I can always run to them. Or if I need help with emails or colleges, they're always there to help me... I know that I can always count on them... "* (Daniella, Y03).

Whether Daniella needed emotional or tangible support, she trusted that YEP staff would help her no matter the issue. Her assurance came from the relationships she had built with staff as she participated in the YEP and interacted with its staff. Whether organizing activities, directly administering material support, or talking through a situation, staff consistently supported care

recipients and created trusting relationships with them. In turn, recipients relied on their caregivers and felt assured that their future needs would continue to be met.

Parents also had similar assurances that YEP staff would meet their tangible needs. As a parent who has historically received help from staff, Elizabeth (P01) described her loving affection towards them, viewing them as people who could provide her with the resources to meet her needs:

> *"I love the people at [YEP]. Always. They're always very helpful. Even at times when they're not able to help with the kind of help that you need, they will still push you towards somewhere else that can help"* (Elizabeth, P01).

Throughout her time as a care recipient in the YEP, Elizabeth consistently received help from YEP staff. Earlier in the interview, Elizabeth had noted that "it was good to have a program... that will give them [my children] a head start at doing their homework" (P01) and found the parenting seminars helpful, voicing her appreciation for receiving these services. Even when the YEP could not help meet specific needs, staff looked to connect Elizabeth with resources outside the YEP that could care for her. As care recipients spend time in the YEP, interact with caregivers, and consistently receive care, they develop trust in their caregivers to meet their needs.

4.1.3 Organizing Community Events to Establish Influence. Aside from participating in the YEP and receiving care from its infrastructure, families were also asked by caregivers to participate in activities that cared for the local neighborhood the YEP was situated within, influencing them to develop *attentiveness*, *responsibility*, *competence*, and *responsiveness* as ethical qualities of care. By having recipients organize events that brought caregivers, recipients, and local neighbors together, caregivers encouraged recipients to become caregivers who, in turn, felt that their actions meaningfully contributed towards caring for the broader community.

Attentiveness: Throughout the year, YEP staff had care recipients organize community events that served the local neighborhood. Organizing community events influenced care recipients to be *attentive* toward local needs, encouraging them to consider how best to support their neighbors. As a YEP staff member, Anthony (S02) explained that youth were aware of community matters such that when planning events, he would give youth the agency to manage them at their discretion:

> *"Our teens, [we] rely on them a lot of the time to be the ear and also the voice of that area... They are pretty much always aware of what's going on... The teens come up with the events... [T]hey would come up with ideas of ways that we can bring the community together... [F]or example, one of the ones we did was for Halloween. We had a pumpkin carving, where they got the people of the community... in the space"* (Anthony, S02).

Staff empowered youth to plan and manage events that brought the whole neighborhood together. With some staff supervision, event planning primarily fell upon the youth, encouraging them to utilize their community knowledge to attune to their neighbors' needs and meet them accordingly. Giving youth agency to organize these events, staff encouraged youth to be mindful of neighborhood occurrences and activities, developing attentiveness to the broader community's needs.

Responsibility: YEP staff also adopted a supportive role when planning and implementing events, giving care recipients the *responsibility* to serve their community. Just as the youth had the agency to plan events, staff tasked parents to arrange events, such as aid distribution and community dinners, that care for their neighborhood. As a parent in the YEP, Janet (P03) discussed her role in helping manage these events and why staff often deferred event organizing to parents:

> *"... [T]hey'll [YEP staff] make sure that the community are the one that's planning the event... [Y]ou actually put in the work because you know the people around you... even though they [YEP staff] doing the event for you, they want you to be a part of it and to participate because they want your input, they want you to work"* (Janet, P03)

YEP staff had parents volunteer their time and efforts to serve others, recognizing that parents knew those in the community and were more attuned to local needs (i.e., attentiveness) since they themselves lived in the neighborhood. They also recognized that being responsible and committed towards others required directing effort and work towards resolving the needs of those one cares about, subsequently deferring tasks to the parent volunteers.

Competence: YEP staff were also mindful of care recipients' capabilities and would provide resources to support youth and parents as *competent* caregivers. For instance, the YEP's community engagement program instilled youth with life skills, such as business management and entrepreneurship, that also functioned to competently care for the community. According to Janet (P03), YEP staff tasked youth with operating a small café for local neighbors so that youth could learn and apply these skills to serve the neighborhood:

> *"They [YEP staff] don't just trying to help the kids. So they teach the kids how to help the community... they allow the older kids to do the work... [Y]outh have a café right on top of the afterschool program for the high schoolers where they help the high schoolers try and apply for a job or try and train them for life after high school"* (Janet, P03).

In addition to providing resources, opportunities, and curricula that helped instill life skills in youth, the YEP's human infrastructure leveraged these skills and had youth run a community café to serve the neighborhood. Janet's description of the cafe's functionality emphasizes the importance of this infrastructure: not only do programs and services provide life skill development for the benefit of youth, but these skills are also used to care for their community. As youth participate in caring for the community, they are also trained to give quality care.

Responsiveness: Care recipients also showed capacity to reflect upon their caregiving once it had been received by community members, demonstrating a *responsiveness* in their care. When asked about her interactions with neighbors through her participation in the YEP, Sasha (Y02), an adolescent involved in the YEP's community engagement program, began to reflect on her experience giving care to community members, expressing how her caregiving meaningfully contributed towards the joy of families:

> *"It [the YEP] makes me feel connected [to the neighborhood] because for example... we have like a big Christmas event... And we give out gifts and different people in the neighborhood come... It makes me feel good that I got to participate in giving people joy... I would hand out gifts or serve food... I would take care of the kids and things like that"* (Sasha, Y02).

Through organized events where care recipients could administer care to neighbors, recipients established a connection to their community by giving care that they perceived as supportive of their neighbors' well-being. For Sasha, she perceived her caregiving in the form of gifts as meaningfully contributing to the joy of families. Here, Sasha evaluated her care for local community members by reflecting on the families' responses to her gift-giving. Assessing these responses, previous care recipients like Sasha begin to make judgments about their caregiving. When tasked by YEP staff to attune to the needs of community members when organizing events in the future, care recipients can recall the responses of these families, restarting the caring process (see also [94]).

4.1.4 Participating in Safe Spaces to Establish Membership. As described in Section 4.1.1, youth's participation in organized activities created opportunities for youth to become comfortable with peers and adults. In these activities, care recipients felt their opinions and being mattered to caregivers and were accepted by them, becoming comfortable enough to express themselves. Debra (S04)—one of the staff in the YEP who works with the children in the program—expressed the importance of creating a space where children feel as though their opinions matter:

"... [T]he main thing is that we give them a space. Kids... have thoughts... [W]hy not provide a place that's non-threatening, non-judgemental. Let them say what they need to say... These are children... If we leave you [children] there, then when the next thing comes... you're going to follow that same negative pattern" (Debra, S04)

Here, Debra emphasized the need for children to voice their concerns and encouraged activities that create an environment where care recipients could feel emotionally safe. Evident in the activities that are arranged in the infrastructure (e.g., the campfire activity in Section 4.1.1), YEP staff desired youth to feel heard when participating in the YEP and intentionally organized activities where youth could express themselves freely and vulnerably.

As caregivers created space for care recipients to feel heard, recipients progressively felt accepted for who they were. Because of the close relationships she had built with staff and peers in the YEP, Maya (Y01), a youth in the community engagement program, expressed the ease with which she could share her problems with others and the emotional support she would knowingly receive:

"... [W]e have this safe space to express ourselves and to just be with one another... [A]ny conversation... I feel comfortable enough to tell one of the instructors... I have a place where I can talk about it and not feel shunned... [A]t least in [YEP] I have a place where I can confide in them and say, 'This is what I believe in. This is what I stand for.' I can feel heard by the members in the... program" (Maya, Y01)

The ease with which Maya could express her anxieties and concerns with others—due to the loving acceptance that she would knowingly receive—demonstrated a perceived membership that came from receiving consistent care. Later in the interview, Maya mentioned that even if she "... had a different ideology than them [YEP staff], they would still support me" (Y01), suggesting that her thoughts and experiences were unconditionally respected by YEP members. Caregivers' attendance to the emotional needs of care recipients not only emotionally supports recipients but also bestows value onto them, signaling to them that their concerns matter and their being is cherished.

4.2 Repairing Infrastructural Breakdowns to Maintain a Sense of Community

Many infrastructures broke down from social disruptions caused by the pandemic, including the human infrastructure of the YEP. Social distancing policies enacted in response to the pandemic restricted recipients from in-person activities, requiring them to participate online to receive care. With many low-SES families lacking the technology to participate, caregivers aligned resources to provide families with ICTs and internet access, relying on a sociotechnical infrastructure to provide care. As a community partner to the YEP who often worked with the same families, Annie (C01) described how caregivers disseminated ICTs to families:

"[T]echnology was... a main barrier for people. So they [the local school system] were immediately distributing Chromebooks and hotspots... I was trying to figure out ways to make sure families were getting those resources... A lot of them [families]... [lacked] access to an actual piece of technology... [T]he majority of them do have smartphones... WiFi can be an issue... [I]f you don't have WiFi... you can't do much" (Annie, C01).

Recognizing that low-SES families did not have computing devices and home internet access, school administration, like many across the United States [8, 12], aligned Chromebooks, mobile hotspots, and informational resources with local organizations like Annie's to infrastructure online connectivity for families. With families having these technologies, YEP caregivers also aligned ICTs, additional resources, and online activities, infrastructuring technology-mediated care that maintained a sense of community. This infrastructuring enabled care recipients to participate in online spaces to maintain *membership*, find material support that continued to *fulfill their needs*, and sustain *shared emotional connections* with caregivers from a distance. Notably, repairs to the

human infrastructure did not include recipient-led community events that continued to *influence* care recipients to become caregivers, which we discuss in Section 4.3.

4.2.1 Creating Online Social Spaces to Maintain Membership. Observing that youth needed a social environment to maintain their sense of community, YEP staff aligned ICTs, activities, and resources to recreate a social space where YEP members could still gather and interact. Staff also acknowledged moments of social unrest during this period, such as the police killings of George Floyd and Breonna Taylor [41, 93], the attack on the United States Capitol [3], and the COVID-19 lockdown [104], to be stressful for youth. In response, Anthony (S02) arranged an online space for adolescents to express their feelings about these events and receive emotional support:

> *"[These] 'Let Me Vent Workshop[s]'... operates as a opportunity for them... to see that, 'It is okay... to feel the way I feel, and my perspective and opinion is appreciated'... A lot of people didn't feel safe enough to... discuss what was being shown, and we actually gave them that space. [I]t allows them to feel heard... because many, many times they don't necessarily always have someone to speak about that with"* (Anthony, S02).

Concerned that youth could not voice their anxieties, YEP staff arranged online workshops to meet their emotional needs. These online activities resembled the spaces that YEP staff had organized where youth could safely share their concerns with others in person (see Section 4.1.4). Although social distancing disrupted the YEP's in-person programs, staff repaired these breakdowns by organizing online activities for youth to continue sharing their opinions and feel valued by other members, infrastructuring technology-mediated care that maintained membership.

Through the online gatherings arranged by staff, YEP youth felt that their opinions mattered through these online conversations, maintaining their status as valued community members. Daniella (Y03) recounted her experience with sharing her thoughts and feelings on these online spaces during the pandemic, emphasizing the emotional support she had received through her interactions with others over Zoom and text messaging:

> *"... I was comfortable to explain how I felt without no criticism coming back towards me, so that made me very happy that I can express how I felt... With my friends it would... like our group chat. For [YEP] it would be our Zoom calls... Like every time we're on Zoom, I would just jump in, say my opinion... So my group chats... I would just text whenever about how I feel and then they'll all just respond"* (Daniella, Y03).

Daniella appreciated the online space to voice her thoughts on ongoing social disruptions and the non-judgmental responses she had received from peers and staff in the YEP. Responding to Daniella's feelings without criticism or scrutiny, staff and peers implicitly reaffirmed that her opinions mattered to them and that they respected her. Through aligning an array of ICTs like video-conferencing tools and text messaging to structure the online gatherings and maintain contact with YEP members, caregivers infrastructured care that reassured youth of their belonging within the community as valued members of the YEP.

4.2.2 Providing Resources from a Distance to Integrate & Fulfill Needs. Social restrictions in response to the pandemic may have stymied the transmission of COVID-19; however, these policies also broke down economic infrastructure, disrupting supply chains and decreasing demand for services. Economic ramifications rippled out to families in the YEP, who experienced job layoffs, rent increases, and a lack of necessities. YEP staff, such as Anthony (S02), responded to the worsening financial situations of local families by sharing informational resources to hopefully connect them with other caregivers who could ameliorate their condition:

> *"... It's really just a big cycle of information being passed along from... one program to the next... It's just pretty much our entire team and the other organizations that we have*

that contact and pass us the information... [Then] [y]ou're constantly contacting them [youth]... You really just want to make sure they got their information, because it could be resourceful... Rent is going up. People are losing jobs" (Anthony, S02).

With worsening economic conditions and the emergence of new practical needs, YEP staff, such as Anthony, cared for families by connecting them to information that staff would receive from other organizations. Similar to Section 4.1.2, staff aligned cross-organizational connections and resources to connect families to helpful information that they could use to find adequate care. Staff sustained their care for families by aligning resources, actors, and organizations to maintain families' expectations that staff would continue to meet their practical needs during this time.

To care for these families from a distance, YEP staff relied on ICTs like phone calls, texts, and emails to share informational resources and communicate with families to ensure they received proper care. For instance, Brianna (S01) described how staff would make monthly phone calls to check in on families and send emails with informational resources to meet their practical needs:

"... [E]very single month... our staff divides up our list of families... who haven't connected with us, or their child is just not online with us... they're calling the families... They're just doing a little, 'How are you doing? Do you need anything? We're still here if you need it'... I might get emails about... a food pantry [or] something. So I might just shoot that out for families, so they have that notice" (Brianna, S01).

During the pandemic, many families who once participated in YEP activities could no longer attend online activities arranged by YEP staff. Committed to still caring for families, staff integrated ICTs like phones, emails, and SMS to proactively check on the well-being of families, assess their needs, and disseminate information. Although ICTs were used before the pandemic, YEP staff relied on them more to make contact and share resources with families since in-person participation was no longer possible and certain families no longer participated in online YEP activities. Thus, staff aligned ICTs with check-ins and informational resources to repair the YEP's infrastructure, relying on a sociotechnical infrastructure to meet the needs of families from a distance.

4.2.3 Communicating Over ICTs to Maintain Shared Emotional Connection. Just as YEP staff relied on ICTs to infrastructure care from a distance and connect care recipients to resources, staff also used ICTs to maintain shared emotional connections with recipients. Although YEP members could not meet in person and discuss personal matters, they communicated over ICTs to give and seek emotional support. For example, Anthony (S02) had initially called a high school senior over the phone to discuss logistical matters related to schooling, but as the youth shared vulnerably, Anthony took time to empathize with the youth's concerns:

"He was getting ready for college... But he was really just mentioning just how this transition is a scary one, mainly because he recognized that he's about to be out on his own... I could hear the anxiety that was building up, and fear does come along with it. It put me back in his space where when I was in a similar situation... Recognized that fear of... being more independent. Just to allow him to see and understand... that he got it, and, 'You got the assistance that you need. It's no different just because you graduated. You still have us that you can rely on'" (Anthony, S02).

When care recipients are contacted by caregivers over ICTs and asked if they have any practical needs (see Section 4.2.2), care recipients may share their pent-up anxieties, creating a moment for caregivers to listen to their concerns. In the case of Anthony's phone call with a graduating high school senior, an innocuous conversation about graduation escalated into a heart-to-heart about an adolescent's worries about the future. Especially when COVID-19 inhibited face-to-face conversations, YEP staff integrated ICTs into the infrastructure to maintain communication from a

distance, creating moments for recipients to share vulnerably with caregivers. By having vulnerable moments over technology-mediated communication, caregivers and recipients can emotionally bond over similar experiences, maintaining shared emotional connections.

Infrastructural breakdowns from the pandemic also catalyzed shared emotional connections. The inability to work around or repair breakdowns created opportunities for individuals to seek and find emotional support from others. As an adolescent in the YEP who had to finish her last year in high school online, Olivia (Y05) described a situation where her failure and frustration to repair breakdowns in the educational infrastructure and obtain a code to take an online test led her to seek consolation from YEP peers via phone and text messaging:

> "... [My YEP friends and I] talk about school because school's a lot right now... I'm trying to get my diploma and they [school administration] say that you can get three hours every time you take a[n] [online] test... [but] I have to get a code to go to take tests... But now I have to keep calling a whole bunch of people just so that I can get a code... I still don't get the code... I like sharing [these] things with them [YEP friends]... Makes me feel like they actually get what I'm saying... [T]hey... give me advice... [o]r they'll just be like, 'Yeah, I understand. I know where you're coming from'" (Olivia, Y05).

Navigating through an unfamiliar education system, Olivia tried to pull actors, organizations, resources, and systems into alignment to graduate, but to no avail. In her failed infrastructuring, Olivia sought solace from her YEP friends through phone calls and text messages. Her friends could empathize with her struggle, understanding that navigating through a new education system came with frustrations and difficulties. Struggles with bridging gaps in the system created opportunities to emotionally bond over relatable struggles through technology-mediated communication when in-person interactions could not occur. As such, infrastructural breakdowns, such as those experienced by Olivia, formed a context to use ICTs to receive care and maintain shared emotional connections.

4.3 The Constraints of Other Infrastructures That Disrupted a Sense of Community

By integrating ICTs into existing practices, YEP members aligned and relied on a sociotechnical infrastructure that repaired the infrastructural breakdowns from COVID-19, maintaining *membership*, the *fulfillment of needs*, and *shared emotional connections* previously established through in-person care but now maintained from a distance. Nonetheless, the pandemic broke down other heterogeneous infrastructures that care recipients had to rely upon or abide by for their survival. Bound to these infrastructures, recipients became entangled in these infrastructural seams [96], imposing constraints that excluded participation in the YEP's sociotechnical infrastructure. Namely, recipients were committed to government, economic, and telecommunications infrastructures whose breakdowns and limitations created *online disengagement*, *financial instability*, and *unreliable connectivity* that interfered with online participation. With their participation incapacitated by infrastructural seams, recipients had difficulty fully experiencing the sense of community they had felt in person.

4.3.1 Getting Caught by Government Infrastructure: Online Disengagement. During the pandemic, government infrastructure, comprised of elected officials, public administration, and government agencies, facilitated policies meant to curb the transmission of COVID-19. In the United States, state governments—together with guidance from the federal government, public health institutions, and other regulatory bodies—enacted mandatory stay-at-home policies with subsequent re-evaluations, changes, and extensions to social distancing measures conducted on an ongoing basis [69, 104]. However, social distancing policies varied across local, state, and federal levels, with some public health experts suggesting that uncoordinated government responses unnecessarily extended the severity of the pandemic [35, 47, 72, 91]. Mixed communication and policies by the government

limited the in-person operations of non-essential businesses and institutions—including the YEP we collaborated with—throughout the United States from early 2020 to mid-2021.

As described in Section 4.2, YEP staff quickly infrastructured care by aligning ICTs, online activities, and resources to maintain members' sense of community in response to social restrictions. Despite caregivers employing ICTs to support *membership* and *shared emotional connections*, care recipients voiced feeling distracted and disengaged when using ICTs, even during early to mid-2021 when we conducted these interviews. With in-person gatherings limited by extended social distancing policies, YEP members had to cope with using ICTs to maintain a sense of community. However, as we expand upon below, these technologies could not replicate the experience of face-to-face interactions, creating an unideal social space that disincentivized members from participating.

Although caregivers infrastructured care by aligning ICTs and online activities for care recipients to share their emotional needs, care recipients felt distracted during online participation. When asked to compare the interactions she had in-person versus online, Sasha (Y02) noted her lack of focus and attention during COVID-19 when school activities were online:

> *"… I like it in-person better because I will focus more… [I]nstead of being on my phone during class, I can actually listen to the teacher… Because it can be really boring. Sometimes, people don't answer and then… I'm left to answer the questions, and I get tired very easily, and… I can't focus for a long time… Since nobody else is doing the work, I guess I don't have to do it either, and I can just be on TikTok"* (Sasha, Y02).

Similarly, Elizabeth (P01) expressed distractions from her surroundings that pulled her away from listening to the prayers and needs of her church peers when meeting over the phone:

> *"[W]e're still praying the same, but… [i]n-person… is better… You can easily get distracted on a phone, especially in your environment… But I feel like, when we're together in one room… I feel like the connection is more deeper"* (Elizabeth, P01).

At times, the group interactions with others in online spaces became chaotic and disorganized, making it difficult to feel heard. As a youth who participated in online spaces, Olivia (Y05) explained why she sometimes felt unheard when talking with YEP peers over FaceTime:

> *"[Online communication] can be different… [S]ometimes they don't listen or sometimes… while I'm talking… there's people talking over me… On FaceTime, you can see their reaction, but if it's a lot of people talking or it's a lot of noise in the background… then it's kind of hard to understand. And then I feel like in-person… [there] could be a lot going on, but it's not to the point where you can't hear them"* (Olivia, Y05).

During the pandemic, care recipients perceived technology-mediated communication as less than ideal compared to in-person interactions. For both Sasha and Elizabeth, external stimuli distracted them from fully attending to their online activities. As for Olivia, disruptions within online activities, such as YEP members talking over one another, can create an environment where recipients feel unheard. With distractions that pull one's attention away from others, YEP members may be unattuned to each others' needs and miss opportunities to affirm and emotionally relate, hindering the ongoing maintenance of *membership* and *shared emotional connections*. Yet, without alternative means to connect, recipients had to rely on ICTs to maintain their social ties amid the extended social restrictions imposed by government infrastructure.

Continued distractions and frustrations with technology-mediated communication can make online participation tiresome and laborious for care recipients, especially when compounded with psychosocial stressors (e.g., job layoffs and rent increases) from the pandemic. YEP staff, such as Anthony (S02), understood that constant technology-mediated communication amid an ongoing

pandemic could feel fatiguing for members; as such, they attempted to create an online YEP environment where youth did not feel as though they were obligated to work and accomplish tasks:

> "[E]ven when we was meeting in-person... [a] lot of it came with the... opportunity that they can have to be with their friends... but we always tend to get down to the gritty and get a lot of work done in the process. With it being virtual... [t]hey don't have that same social opportunity... [W]e have to make it fun for them... to come in that space... You're in front of a computer all day, and now we're asking you to be in front of there just a little bit longer... [W]e're doing a good job of making it not feel like school... Even not even making it feel like a after-school program is a plus" (Anthony, S02).

For organizations like the YEP, in-person activities had previously required care recipients to put forth significant work and effort that may be laborious to sustain during an ongoing pandemic. With psychosocial stressors weighing upon many of the families and distractions with using ICTs, care recipients may not have prioritized nor desired to attend online activities, especially if significant effort and attention are required to participate. Acknowledging these difficulties, YEP staff, such as Anthony, re-aligned the online environment to create a fun and engaging space for youth and retain attendance, pivoting away from activities that required significant work.

However, by removing these activities, caregivers may have unintentionally removed components of the YEP's infrastructure that had facilitated a sense of community. As previously described in Section 4.1.3, community-building events that *influenced* care recipients into becoming caregivers had required time and effort to organize. With YEP staff moving away from event planning, staff had fewer opportunities to maintain influence and encourage the qualities of care instilled into recipients. Care recipients like Camila (P02) and Janet (P03)—parent volunteers at the YEP—noted the lack of community-building events since the beginning of the pandemic:

> "We had a event virtual last year, but we haven't have anything this year [as of April 2021] yet. Probably it'll get started in upcoming weeks for [YEP's] Back-to-School Bash" (Janet, P03).

> "... [M]y only sense of belonging is [YEP] and that maybe is not even so much anymore because it's virtual. Back when it was in-person, every so often they would have these nights when you could come and they would engage you in something, maybe have some kind of presentation or have some kind of culture activity" (Camila, P02).

Community-building events that once facilitated care recipients into becoming caregivers occurred less frequently as social restriction policies limited the kinds of online activities YEP staff could infrastructure without exhausting and overwhelming recipients. Recipients like Janet and Camila, who had previously organized these events, felt the lack of community-building events, with little knowledge of when event-organizing activities would resume. Although community-building events influenced care recipients to become caregivers, social distancing policies facilitated by government infrastructure limited what staff could feasibly arrange as online activities while retaining recipients' participation. Thus, activities to organize community-building events and *influence* care recipients occurred infrequently since caregivers could not feasibly sustain recipients' participation if they continued to organize activities that required significant time, work, and focus.

4.3.2 Getting Caught by Economic Infrastructure: Financial Instability. As previously discussed in Section 4.2.2, social distancing policies deleteriously affected the economy, breaking down economic infrastructure. Because of economic volatility from COVID-19, low-SES communities experienced rising rent costs and job layoffs. These breakdowns affected many families in the neighborhood, who financially struggled as businesses laid off workers or reduced employee work hours to cut costs. To support their families, youth took on part-time jobs or spent more time at home caring for

their siblings. With additional responsibilities, youth had less time and capacity to participate in the online activities created by the YEP or reach out to staff for any needs they may have. Anthony (S02) noted that because youth could not actively participate in the YEP's online activities, YEP staff aligned resources and proactively contacted youth, hoping that the support would at least alleviate some of the stress associated with surviving through a pandemic:

"... [W]ith everything that's going on... everybody is pretty much playing this game of survival... Unfortunately, a lot of our teens felt the need to step up... to cut back on the struggle that their parents are dealing with, so a lot of them are now working in high school as well. [We're] [j]ust trying... let them know that, 'We are here if you need assistance... We're not trying to hassle you... [W]e really just want to ensure that we can take as much stress and load off of your shoulders as possible'" (Anthony, S02).

Observing youths' added responsibilities to care for their families, YEP staff did not push them to participate in YEP activities like organizing community events. YEP staff like Anthony (S02) understood that youth wanted to enjoy the remaining free time they had:

"[W]hen you [adolescents] finally do get the free time, of course you're going to... take that time to enjoy yourself... I just feel like if you're not seeing a face every day, and you have other responsibilities, and a little bit more on your plate than normal, and then on top of that you're going to always want your free time to... enjoy yourself, it limits the room to even make the time for it [participating online]" (Anthony, S02).

With the pandemic creating additional financial burdens on low-SES families, staff understood that youth and parents did not have the capacity to participate in YEP activities. Staff instead infrastructured care by providing proactive emotional support and financial resources for families in addition to creating a virtual environment where youth could enjoy themselves while surviving the pandemic, rather than continue with activities that focused on *influencing* care recipients (see also Section 4.3.1). Despite caregivers' attempts to alleviate their responsibilities and incentivize participation, recipients focused their time and energy on themselves and their families' survival.

Financial instability from the pandemic also limited opportunities for care recipients to socialize, as they prioritized surviving the pandemic rather than continuing to maintain their *membership* and *shared emotional connections*. For instance, Elizabeth (P01) noted a lack of in-person or online interactions with YEP parents because everyone had to care for themselves and their families:

"... [W]e don't see each other anymore... I think the only time I saw them last was when we had a meeting, which was on Zoom... I felt they [conversations with other parents] have stopped because everybody's basically doing their own thing. We're not at the program... I guess everybody's just... trying to survive" (Elizabeth, P01).

Similarly, when asked about her relationships with peers during the pandemic, Olivia (Y05) described the lack of interactions she would have with YEP peers due to their part-time jobs:

"We talk, it's just rare... [W]e plan things, but it doesn't really happen... I think most of the times people are busy with school and I think... most of them work... Because... they say that they miss [YEP], but I feel like them sitting in the house, I feel like they needed a distraction other than... school and they chose work" (Olivia, Y05).

Although caregivers integrated ICTs to create a sociotechnical infrastructure that maintained *membership* and *shared emotional connections* (see Sections 4.2.1 and 4.2.3), many care recipients could not participate in online YEP activities and maintain communication with one another. According to Elizabeth and Olivia, the additional busyness brought on by work limited recipients' capacities to participate in the YEP. Although caregivers labored to care for recipients and repaired the YEP's human infrastructure to maintain membership and shared emotional connections by

mitigating financial stressors (see Section 4.2.2), caregivers could not resolve economic breakdowns beyond their control. Consequently, caregivers could not free recipients from being hemmed in by the breakdowns of economic infrastructure, such as job layoffs or rent increases.

4.3.3   Getting Caught by Telecommunications Infrastructure: Unreliable Connectivity. Constraints by telecommunications infrastructure also interfered with the repairs made by caregivers. Many low-SES families relied on monthly prepaid plans for their phone services. However, if prepaid plans have lapses in monthly payments, cellular service providers will shut off these services. Annie (C01) expressed difficulties contacting families during the pandemic because they would miss monthly payments, have their old phone lines close, and have outdated contact information:

> *"It can be hard to get in contact with a family... a phone might have gotten shut off... [because they're] just on a [monthly phone] contract plan. So it could be shut off... [if] you didn't... pay it... [I]f you don't use email, and your phone shut off, I don't really know how to best reach you... And they're not calling everybody... and telling them that... [T]hat [shutoffs] happens a lot"* (Annie, C01).

When prepaid phone contracts have lapses in monthly payments, providers will close phone lines, requiring users to open new lines and change their phone numbers. According to Annie, constant changes in phone numbers prevented her from knowing how to contact and provide care for recipients. Although some families had alternative communication methods, calls and text messaging were often the default communication channels for giving and receiving care. Unless recipients announced changes to phone numbers, caregivers like Annie could not reach families who may have required care. Difficulties with directly contacting care recipients inhibit caregiving that maintains a sense of community. As discussed in Sections 4.2.2 and 4.2.3, caregivers incorporated and relied on ICTs like phone calls and text messaging to *fulfill practical needs* and maintained *shared emotional connections* with care recipients.

Poor network performance (i.e., low bandwidth or high latency) also disrupted technology-mediated communication and hindered YEP members from maintaining strong social ties with one another. Despite the local school system providing mobile hotspots for internet access (see Section 4.2), hotspots have data caps and bandwidth limitations, causing internet speeds to slow when usage exceeds these limits [20, 54, 83]. And although many internet and cellular service providers increased data caps and lowered costs for more low-SES families to access the internet, these changes existed for only a short period of time [18, 26, 77]. Families did not have a long-term sustainable solution for using online services (e.g., Zoom) that quickly consumed large amounts of data [108] to participate online without suffering poor network performance from data throttling and deprioritization [20, 54, 83]. When asked about difficulties in the online learning environment, YEP staff, such as Kathy (S03), consistently mentioned the unreliability of internet connections among residents in the neighborhood that deterred youth from attending:

> *"... [A] lot of the students' internet connection... goes out all the time. So they get booted out of the Zoom meeting... [I]t really disrupts working with them... And it's unfortunate, because it's like, we can't change their internet connection... there was a lot more kids than the seven or eight that we have [now] on a daily... I think that's another reason why some might not even attend online... because they're like, 'Well, I'm just going to continue getting booted out. And then I'm not going to learn anything...' [Y]ou can't build connections if... you literally can't connect"* (Kathy, S03).

Even when care recipients could participate in online YEP activities, poor network performance limited the quality of interactions one could have online. As later mentioned by Kathy (S03), these

technical limitations disrupted relational maintenance whenever youth participated in online YEP activities but needed to have their cameras turned off to tenuously maintain online connectivity:

> *"... [S]ome of the kids... have not been able to [go through it] as well... because of internet connections... [T]hey keep getting kicked out [of Zoom] and it's hard for the kids to build a relationship with talking to yourself when sometimes... the other students' cameras... are not able to be turned on because of the internet connection"* (Kathy, S03).

Consistent online disconnections due to poor network performance hindered relational maintenance and participation. Since audio-only capabilities require relatively less network bandwidth (e.g., [108]), youth could turn off their cameras to maintain their connection. Yet, the subsequent lack of visual modalities can create a 'black screen' environment [106] that interferes with social feedback and relational maintenance over technology-mediated communication. According to Kathy, youth became frustrated with these interferences and no longer wanted to participate, as indicated by the lower online turnout rate among youth. Feeling valued as a YEP member is difficult if care recipients cannot seamlessly participate in online spaces arranged by staff to promote *membership* (see Section 4.2.1). Caregivers had the means to repair the YEP to facilitate a sense of community; however, as noted by Kathy, YEP caregivers were powerless to directly give better network performance to care recipients as infrastructuring the network was beyond their capabilities.

5 Discussion & Future Work

In our study, the human infrastructure of the YEP provided care through an array of activities, resources, and actors. Care recipients felt cared for as they participated in an infrastructure that routinely facilitated *membership, integration, influence,* and *shared emotional connections.* Despite the pandemic disrupting in-person caregiving, staff repaired infrastructural breakdowns, incorporating ICTs to rely on a sociotechnical infrastructure for families to receive care online. Yet, care recipients' commitments to other heterogeneous infrastructures deterred recipients from maintaining a sense of community. We consider several implications in light of these findings. First, we expound upon the limitations of receiving care when recipients undergo what Janet Vertesi refers to as "multi-infrastructural torque" [96, p. 13]. Second, we discuss the limitations of caregiving when relying on ICTs to repair infrastructural breakdowns. Finally, we carefully consider assets-based design as a methodology for design researchers to use to sustain a community's well-being.

5.1 Care Recipients: Too Torqued Out to Care

Our findings suggest that the seams of heterogeneous infrastructures created a double bind for care recipients, preventing them from seamlessly participating in online YEP activities. Despite infrastructural repairs, recipients could not disentangle themselves from misalignments among government, economic, and telecommunications infrastructures that impeded their YEP participation: families could not feasibly violate social distancing policies, ignore their financial situation, or afford high-speed networks without additional repercussions to their physical and economic wellbeing. Yet, these infrastructures barely sustained recipients' well-being, instead promoting *online disengagement, financial instability,* and *unreliable connectivity* that excluded recipients' seamless access to the YEP's care. Hindered by misaligned seams but unable to create alignment or escape, recipients had little recourse but to cope with being entangled and experience *multi-infrastructural torque*: the social exclusions produced by the incompatibilities of infrastructural seams [6, 96]. Unable to align these seams, recipients were powerless to seamlessly receive the needed care from the YEP and were subject to the harms imposed by misalignment as they remained trapped.

Care recipients were constrained from giving care to their neighbors as they experienced multi-infrastructural torque. Anthony's comments about youth finding jobs to support their families during the pandemic (see Section 4.3.2) indicated that youth could and wanted to care, but their caregiving was limited to their families' survival. Despite YEP staff encouraging recipients to care for their neighbors, infrastructural constraints left recipients with little resources and capacity to care for their neighbors, aligning with Joan Tronto's [94, p. 170-171] notion of *parochial* care: care that only attends to the needs of those closest to the caregiver. Because care involves a responsibility to others based on relationship, Tronto recognized care's insidious potential to be partial where the needs of those relationally distant are ignored. Whereas commitments to heterogeneous infrastructures before the pandemic may not have been significant enough to inhibit recipients' capacity to care for both their families and neighbors, we suggest that the multiplicity of misaligned seams during the pandemic compounded to create enough multi-infrastructural torque to constrain recipients' caregiving.

The parochial care exhibited by our recipients suggests a lack of care within heterogeneous infrastructures that barely supported recipients' basic needs, requiring them to attend to themselves and their families' needs. According to Tronto, parochial care is exacerbated by neoliberal politics that has historically reified infrastructures that provide care that is barely adequate, privatized, and market-driven in fear that recipients would abuse public care services [95, p. 144–145]. Recipients in our study experienced the neoliberal logics of infrastructures that constrained their caregiving: *online disengagement* from a government infrastructure that prematurely eased social distancing policies to preserve the economy (e.g., [35, 47, 72, 91]), *financial instability* from an economic infrastructure that inadequately disbursed financial relief (e.g., [70, 80, 100]), and *unreliable connectivity* from a telecommunications infrastructure that has been historically privatized (e.g., [11, 14, 20, 26, 77, 89, 107]). These infrastructures facilitated public services and aid to provide care; however, the programs did not provide adequate care to protect recipients from multi-infrastructural torque. Despite YEP staff nurturing recipients' caregiving, care can be non-innocent, in danger of becoming parochial when entangled with the seams of neoliberal infrastructures [64, 94].

Considering our findings, we suggest that care recipients were entangled among misaligned seams with no way out: recipients depended on government, economic, and telecommunications infrastructures for their well-being but could not receive proper care from these infrastructures to participate in the YEP and satisfy their own and others' care needs. Although previous work in technology-mediated care in HCI and CSCW suggests that recipients can find care during ongoing crises [23, 84, 103], recipients in these contexts may not be so strongly committed to heterogeneous infrastructures and experience a multiplicity of infrastructural constraints that severely inhibited recipients from aligning seams to receive care. Building on Murphy's [64] call to unsettle care and its subsequent application within HCI and CSCW [23, 43, 50], we suggest that future work should consider using multi-infrastructural torque and heterogeneous infrastructure as theoretical lenses to further our understanding of care's limitations as an asset for aligning infrastructural seams and the systemic inequities that can result when recipients become entangled within political systems that inhibit their participation.

5.2 Caregivers: Caring Amid a Seam-Ingly Bleak Reality

Our findings also suggest that caregivers' infrastructuring by incorporating ICTs could not disentangle recipients from the constraints imposed by the seams of heterogeneous infrastructures. Kathy's feelings towards youths' internet problems in Section 4.3.3 emphasizes this point: YEP staff cared about youths' lack of quality internet, but the staff's limited resources could not facilitate care recipients' seamless online participation. Whereas previous work has discussed the flexible, opportunistic, and even subversive aspects of infrastructuring to circumvent constraints imposed

by misaligned seams [11, 23, 36, 84, 98], our findings suggest that infrastructuring in this context may work insofar that seams are not severely misaligned as to retain opportunities to work around them. Although YEP caregivers also connected recipients to resources external to the YEP (see Section 4.2.2) to alleviate multi-infrastructural torque, we suggest that the multiplicity of seams imposed too many constraints that even resources like rental assistance could not help recipients seamlessly maintain a sense of community [6, 87]. While well-resourced to repair breakdowns in the YEP, caregivers' repairs could not account for the misaligned seams that entangled recipients.

We suggest that incorporating technological solutions (e.g., ICTs) can resolve infrastructural breakdowns; however, in certain cases, such interventions may only work insofar that infrastructural seams do not generate severe multi-infrastructural torque. Unless caregivers stitch, weave, and align infrastructural seams together, the heterogeneity of infrastructures and the misalignment of their seams may threaten to incapacitate and constrain recipients' participation and courses of action (e.g., [6, 87, 96]). Translating our work to HCI, CSCW, and design, our findings should caution researchers and designers against simple techno-solutionist approaches to solving complex social problems, for even when technological solutions repair breakdowns within an infrastructure, other infrastructures may continue to impose constraints, excluding and working against those at the margins (e.g., [61]). Complementing research that has already cautioned against and critiqued techno-solutionism within CSCW, HCI, and design [19, 24, 33, 86], our work lends additional empirical credence to the notion that simple problem-solution design thinking without considering systemic inequities, barriers, and injustices (i.e., infrastructural seams) can result in technological solutions that fall short of disentangling those who have already been historically excluded and marginalized. We call for future work to use heterogeneous infrastructure and infrastructuring as theoretical lenses to investigate the limitations, sustainability, and impact of technological solutions for resolving issues of social justice in similar marginalized contexts.

5.3 Design Researchers: Is There a Way Out of These Misaligned Seams?

With care recipients and well-resourced caregivers unable to circumvent or align infrastructural seams to maintain a sense of community among YEP members, designers with their artifacts may similarly struggle and fall short of sustainably stitching or working around misaligned seams. In keeping with Vertesi [96], even if actors can stitch seams into local alignment, alignment is often temporary and fleeting, quickly becoming misaligned again as soon as actors accomplish their work. The temporary nature of alignment and the subsequent labor required to constantly re-align seams hardly affords care recipients the sustained interactions needed to maintain a sense of community with others [10, 56, 62]. For technological solutions to sustainably support a sense of community, such artifacts may need to be designed and infrastructured to help care recipients disentangle themselves from their infrastructural commitments or work around them.

Returning to techno-solutionist critiques within HCI, CSCW, and design, there may be some precarious opportunities for design researchers to approach the design of artifacts to resolve multi-infrastructural torque. In critiquing naïve implementations of technological solutions to solve systemic injustices, Cunningham et al. [19] aptly summarize the techno-solutionist dilemma, suggesting that so long as solutions are stitched and tied to the very same infrastructures and systems that exclude and exploit ontological Others (e.g., Blackness), such solutions will ultimately fall short of including those at the margins and reify structural inequities, perpetuating more problems (e.g., [39, 61]). To sustainably escape from such a double bind, they suggest designers "[examine] the solution without the problem" [19, p. 12], rejecting the premise that solutions must be tied to an issue or need, whether defined by designers or those designed for. To sustainably include and serve ontological Others, solutions may very well emerge from the strengths and

capacities of these Others; in other words, solutions emerging from an assets-based rather than a needs-based approach to design.

An assets-based approach focused on designing around the existing strengths and capacities of a community may forgo techno-solutionist models that couch community issues and infrastructural seams as problems that require technical innovations to stitch, align, and resolve. As the original authors of the assets-based model in community development, researchers John Kretzmann and John McKnight [49] define assets as a community's material, social, structural, and skills-based resources. They contend that rather than adopt a needs-based approach and introduce outside resources (e.g., technological innovations) into a community to resolve community problems, low-resourced communities already have untapped and unaligned assets to flourish. Similarly, assets-based design (ABD) focuses on assets rather than needs, using a design approach akin to participatory design and community-based participatory research [101, 102]. Whereas these design methods may still focus on problems and technological solutions [19, 33], ABD does not presume technological solutions as pre-determined end goals, instead focusing on a solution—technological or otherwise—that best support these assets [102]. Solutions from ABD are not designed based on a defined problem but on aligning pre-existing resources within a community.

We suggest that ABD, as a methodology, may resolve some of the limitations of care and infrastructuring observed in our work by democratically distributing the responsibility of caregiving across the broader community and opportunistically aligning previously untapped assets. Although the responsibility to care for the community primarily fell upon YEP caregivers in our study, Xu and Maitland's [105] co-design with refugees suggests the potential for ABD to encourage everyone in the community to care together. Their design and development of a data repository of assets established a sense of community among refugees and raised their awareness of available assets to later leverage. These findings suggest that ABD can be a space where community members can build *solidarity* [95] and pool assets, relying upon each other in times of need. Contextualizing ABD to our study, we suggest that neighbors whom YEP staff, youth, and parents served have assets that can be integrated into the YEP's infrastructure, infrastructuring routine care that invites the broader community to contribute democratically towards caregiving. Although misaligned seams threatened to constrain those marginalized from contributing towards caregiving in this community, we are cautiously optimistic, observing previous work (e.g., [23, 36, 84, 98]) that has described moments where actors worked around infrastructural constraints to infrastructure care. ABD may reveal and align just enough assets to circumvent infrastructural seams that conflict with care, infrastructuring democratic forms of care for similar marginalized communities.

Nonetheless, we are skeptical about the prospect of ABD as an alternative approach to traditional methods of designing thinking, for as much as we are optimistic of ABD's potential to create openings to work around infrastructural seams, we are wary of the systems and infrastructures whose misaligned seams have historically oppressed and reified systemic injustices, seeking to dominate, exclude, and annihilate those that do not conform to the demands and standardizations of more powerful infrastructures [6, 19, 87]. Our findings suggest that—so long as their being hinges upon infrastructures for their very survival—care recipients, even with infrastructuring together a set of assets, may struggle to sustainably disentangle themselves from these infrastructural seams that continuously work to exclude them. Even though care functioned as an asset that established and repaired a sense of community in the YEP, families continued to rely upon these heterogeneous infrastructures and were excluded from participating online. Under certain circumstances where actors are hemmed in by a multiplicity of infrastructures, infrastructural seams may apply significant multi-infrastructural torque, making repairs futile. Yet, we remain cautiously hopeful, calling for future work to investigate the potential capacity of ABD and its outcomes to facilitate

flourishing communities, testing the sustainability and power of an assets-based approach to support marginalized communities' social and emotional well-being when multi-infrastructural torque may inhibit low-resourced individuals' capacities to experience such well-being.

6 Study Limitations

We acknowledge several limitations to our study. First, we interviewed active YEP members but did not engage with the broader community the program was situated within. Notably, the YEP works with many Spanish-speaking families in the neighborhood and various community institutions, expanding the scope of the YEP's infrastructure. Because of language barriers, disruptions from the pandemic, and the nature of snowball sampling, we could not connect with other community stakeholders, limiting our understanding of the human infrastructure and the implications of care on community members at large. We encourage future work to engage with different subgroups within a community to understand variations in perspective, especially those historically marginalized, to further enrich theories of care and infrastructure. Second, semi-structured interviews limit us to reporting phenomena that our participants perceive. Although we volunteered at the YEP to contextualize the interview data, our participation may still miss significant interpersonal interactions and activities in the YEP. Finally, we derived findings from interviews with members of only one YEP. Our findings around infrastructural breakdowns and repair may not be transferable to other social contexts or even other YEPs. Nonetheless, our findings are still applicable for CSCW researchers to understand the lived experiences of those physically separated from their communities due to crises, scaffolding future work that studies sites of infrastructural breakdowns.

7 Conclusion

The COVID-19 pandemic is certainly not the first crisis, but neither will it be the last. Future crises, such as the pandemic, will likely continue breaking down critical infrastructures that support low-SES families, disrupting their well-being, and exacerbating long-standing inequities. In this study, we aimed to understand how a YEP's infrastructure supported families during a particular crisis that disrupted in-person gatherings and to reflect on an equitable approach for designing future sociotechnical systems for the well-being of marginalized communities. By examining a YEP's human infrastructure that cared for youth and parents in a low-SES neighborhood, we found that activities, resources, and interpersonal interactions scaffolded a sense of community before the pandemic. Although YEP staff labored to care for youth and parents, this feeling could not be re-established over technology-mediated communication because of systemic barriers that interfered with online participation. From these findings, we contribute insights towards limitations to technology-mediated care when a marginalized community experiences multi-infrastructural torque and warily call for CSCW design researchers to equitably care for these communities by focusing on assets rather than needs.

References

[1] Dagmar Abfalter, Melanie E Zaglia, and Julia Mueller. 2012. Sense of virtual community: A follow up on its measurement. *Comput. Hum. Behav.* 28, 2 (March 2012), 400–404. https://doi.org/10.1016/j.chb.2011.10.010

[2] Emily A Benfer, David Vlahov, Marissa Y Long, Evan Walker-Wells, J L Pottenger, Gregg Gonsalves, and Danya E Keene. 2021. Eviction, Health Inequity, and the Spread of COVID-19: Housing Policy as a Primary Pandemic Mitigation Strategy. *Journal of Urban Health* 98, 1 (2021), 1–12. https://doi.org/10.1007/s11524-020-00502-1

[3] Aaron Blake. 2021. *'Let's have trial by combat': How Trump and allies egged on the violent scenes Wednesday.* The Washington Post. Retrieved July 4, 2023 from https://www.washingtonpost.com/politics/2021/01/06/lets-have-trial-by-combat-how-trump-allies-egged-violent-scenes-wednesday/

[4] Anita L Blanchard. 2007. Developing a Sense of Virtual Community Measure. *CyberPsychology & Behavior* 10, 6 (Dec. 2007), 827–830. https://doi.org/10.1089/cpb.2007.9946

[5] Nisha D. Botchwey, Nick Johnson, L. Katie O'Connell, and Anna J. Kim. 2019. Including Youth in the Ladder of Citizen Participation. *Journal of the American Planning Association* 85, 3 (2019), 255–270. https://doi.org/10.1080/01944363.2019.1616319

[6] Geoffrey C. Bowker and Susan Leigh Star. 2000. *Sorting Things Out: Classification and Its Consequences.* The MIT Press, Cambridge, MA.

[7] Bernadine Brady, Pat Dolan, and John Canavan. 2017. 'He told me to calm down and all that': A qualitative study of forms of social support in youth mentoring relationships. *Child & Family Social Work* 22, 1 (2017), 266–274.

[8] Kiara Brantley-Jones. 2020. *Digital divide amplified: Schools scramble to provide at-home learning options.* ABC News. Retrieved April 1, 2024 from https://abcnews.go.com/US/digital-divide-amplified-schools-scramble-provide-home-learning/story?id=72237236

[9] Virginia Braun and Victoria Clarke. 2021. *Thematic Analysis: A Practical Guide* (first ed.). SAGE Publications Ltd, Thousand Oaks, CA, USA. https://uk.sagepub.com/en-gb/eur/thematic-analysis/book248481

[10] Anne E Brodsky, Patricia J O'Campo, and Robert E Aronson. 1999. PSOC in community context: Multi-Level correlates of a measure of psychological sense of community in low-income, urban neighborhoods. *Journal of Community Psychology* 27, 6 (Nov. 1999), 659–679. https://doi.org/10.1002/(SICI)1520-6629(199911)27:6<659::AID-JCOP3>3.0.CO;2-#

[11] Jenna Burrell. 2018. Thinking relationally about digital inequality in rural regions of the US. *First Monday* 23, 6 (June 2018). https://doi.org/10.5210/fm.v23i6.8376

[12] Lauren Camera. 2020. *Disconnected and Disadvantaged: Schools Race to Give Students Access.* U.S. News & World Report. Retrieved April 1, 2024 from https://www.usnews.com/news/education-news/articles/2020-04-01/schools-rush-to-get-students-internet-access-during-coronavirus-pandemic

[13] Linda Camino and Sheperd Zeldin. 2002. Making the transition to community youth development: Emerging roles and competencies for youth-serving organizations and youth workers. *Community youth development anthology* 6, 4 (2002), 213–220.

[14] Becky Chao, Claire Park, and Joshua Stager. 2020. *The Cost of Connectivity 2020.* New America. Retrieved April 11, 2024 from https://www.newamerica.org/oti/reports/cost-connectivity-2020/

[15] Heather M Chipuer and Grace M H Pretty. 1999. A review of the sense of community index: Current uses, factor structure, reliability, and further development. *Journal of Community Psychology* 27, 6 (Nov. 1999), 643–658. https://doi.org/10.1002/(SICI)1520-6629(199911)27:6<643::AID-JCOP2>3.0.CO;2-B

[16] Adrian Choi, Catherine D'Ignazio, Brooke Foucault Welles, and Andrea G Parker. 2023. Social Media as a Critical Pedagogical Tool: Examining the Relationship between Youths' Online Sociopolitical Engagements and Their Critical Consciousness. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23)*. Association for Computing Machinery, New York, NY, USA, 25 pages. https://doi.org/10.1145/3544548.3580823

[17] Marisa Leavitt Cohn. 2016. Convivial Decay: Entangled Lifetimes in a Geriatric Infrastructure. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing* (San Francisco, California, USA) *(CSCW '16)*. Association for Computing Machinery, New York, NY, USA, 1511–1523. https://doi.org/10.1145/2818048.2820077

[18] Federal Communications Commision. 2021. *Companies Have Gone Above and Beyond the Call to Keep Americans Connected During Pandemic.* Federal Communications Commission. Retrieved April 2, 2024 from https://www.fcc.gov/companies-have-gone-above-and-beyond-call-keep-americans-connected-during-pandemic

[19] Jay Cunningham, Gabrielle Benabdallah, Daniela Rosner, and Alex Taylor. 2023. On the Grounds of Solutionism: Ontologies of Blackness and HCI. *ACM Trans. Comput.-Hum. Interact.* 30, 2 (April 2023), 17 pages. https://doi.org/10.1145/3557890

[20] Mike Dano. 2021. *Here's why your carrier is so scared of your phone's mobile hotspot.* Light Reading. Retrieved April 1, 2024 from https://www.lightreading.com/5g/here-s-why-your-carrier-is-so-scared-of-your-phone-s-mobile-hotspot

[21] Maria Puig de La Bellacasa. 2017. *Matters of care: Speculative ethics in more than human worlds.* Vol. 41. U of Minnesota Press, Minneapolis, MN.

[22] Tawanna R Dillahunt, Alex Jiahong Lu, Aarti Israni, Ruchita Lodha, Savana Brewer, Tiera S Robinson, Angela Brown Wilson, and Earnest Wheeler. 2022. The Village: Infrastructuring Community-Based Mentoring to Support Adults Experiencing Poverty. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (CHI '22)*. Association for Computing Machinery, New York, NY, USA, 17 pages. https://doi.org/10.1145/3491102.3501949

[23] Michaelanne Dye. 2021. Un Grano de Arena: Infrastructural Care, Social Media Platforms, and the Venezuelan Humanitarian Crisis. *Proc. ACM Hum.-Comput. Interact.* 4, CSCW3, Article 247 (Jan. 2021), 28 pages. https://doi.org/10.1145/3432946

[24] Sheena Erete and Jennifer O Burrell. 2017. Empowered Participation: How Citizens Use Technology in Local Governance. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. Association for Computing Machinery, New York, NY, USA, 2307–2319. https://doi.org/10.1145/3025453.3025996

[25] Berenice Fischer and Joan Tronto. 1990. Toward a Feminist Theory of Caring. In *Circles of Care: Work and Identity in Women's Lives*, Emily K. Abel and Margaret K. Nelson (Eds.). SUNY Press, Albany, NY, 35–62.

[26] Jessica Fregni. 2021. *Students and Families Need Long-Term Solutions to the Homework Gap*. Teach For America. Retrieved April 2, 2024 from https://www.teachforamerica.org/one-day/top-issues/students-and-families-need-long-term-solutions-to-the-homework-gap

[27] Shawn Ginwright and Julio Cammarota. 2007. Youth activism in the urban community: learning critical civic praxis within community organizations. *International Journal of Qualitative Studies in Education* 20, 6 (2007), 693–710. https://doi.org/10.1080/09518390701630833

[28] Shawn A. Ginwright. 2007. Black Youth Activism and the Role of Critical Social Capital in Black Community Organizations. *American Behavioral Scientist* 51, 3 (2007), 403–418. https://doi.org/10.1177/0002764207306068

[29] Elizabeth Goodman, Nancy E Adler, Ichiro Kawachi, A Lindsay Frazier, Bin Huang, and Graham A Colditz. 2001. Adolescents' Perceptions of Social Status: Development and Evaluation of a New Indicator. *Pediatrics* 108, 2 (Aug. 2001), e31 LP – e31. https://doi.org/10.1542/peds.108.2.e31

[30] Greg Guest, Arwen Bunce, and Laura Johnson. 2006. How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability. *Field Methods* 18, 1 (Feb. 2006), 59–82. https://doi.org/10.1177/1525822X05279903

[31] Xinning Gui and Yunan Chen. 2019. Making Healthcare Infrastructure Work: Unpacking the Infrastructuring Work of Individuals. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19)*. Association for Computing Machinery, New York, NY, USA, 1–14. https://doi.org/10.1145/3290605.3300688

[32] Ellie Harmon, Matthias Korn, and Amy Voida. 2017. Supporting Everyday Philanthropy: Care Work In Situ and at Scale. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing* (Portland, Oregon, USA) *(CSCW '17)*. Association for Computing Machinery, New York, NY, USA, 1631–1645. https://doi.org/10.1145/2998181.2998330

[33] Christina Harrington, Sheena Erete, and Anne Marie Piper. 2019. Deconstructing community-based collaborative design: Towards more equitable participatory design engagements. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–25.

[34] Monique Hennink and Bonnie N Kaiser. 2022. Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Social Science & Medicine* 292 (2022), 114523. https://doi.org/10.1016/j.socscimed.2021.114523

[35] Heather Hollingsworth and Tammy Webber. 2021. *States easing COVID-19 restrictions despite experts' warnings*. PBS News Hour. Retrieved Feb 18, 2024 from https://www.pbs.org/newshour/health/states-easing-covid-19-restrictions-despite-experts-warnings

[36] Naja L. Holten Møller, Geraldine Fitzpatrick, and Christopher A. Le Dantec. 2019. Assembling the Case: Citizens' Strategies for Exercising Authority and Personal Autonomy in Social Welfare. *Proc. ACM Hum.-Comput. Interact.* 3, GROUP (Dec. 2019), 21 pages. https://doi.org/10.1145/3361125

[37] Larry C Ingram. 1986. Testimony and Religious Cohesion. *Religious Education* 81, 2 (March 1986), 295–309. https://doi.org/10.1080/0034408600810213

[38] Robin L Jarrett, Patrick J Sullivan, and Natasha D Watkins. 2005. Developing social capital through participation in organized youth programs: Qualitative insights from three programs. *Journal of community psychology* 33, 1 (2005), 41–55.

[39] Ian G. Johnson and Vasilis Vlachokyriakos. 2024. Socio-digital Rural Resilience: An Exploration of Information Infrastructures Within and Across Rural Villages During Covid-19. *Proc. ACM Hum.-Comput. Interact.* 8, CSCW1, Article 123 (apr 2024), 30 pages. https://doi.org/10.1145/3637400

[40] Brian M Johnston and Demis E Glasford. 2018. Intergroup contact and helping: How quality contact and empathy shape outgroup helping. , 1185–1201 pages. https://doi.org/10.1177/1368430217711770

[41] Richard A. Oppel Jr., Derrick Bryson Taylor, and Nicholas Bogel-Burroughs. 2023. *What to Know About Breonna Taylor's Death*. The New York Times. Retrieved July 4, 2023 from https://www.nytimes.com/article/breonna-taylor-police.html

[42] Helena Karasti and Karen S. Baker. 2004. Infrastructuring for the long-term: ecological information management. In *Proceedings of the 37th Annual Hawaii International Conference on System Sciences, 2004*. Institute of Electrical and

Electronics Engineers, Big Island, HI, USA, 10. https://doi.org/10.1109/HICSS.2004.1265077

[43] Naveena Karusala, Victoria G, Shirley Yan, and Richard Anderson. 2023. Unsettling Care Infrastructures: From the Individual to the Structural in a Digital Maternal and Child Health Intervention. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23)*. Association for Computing Machinery, New York, NY, USA, 16 pages. https://doi.org/10.1145/3544548.3581553

[44] Naveena Karusala, Aditya Vishwanath, Arkadeep Kumar, Aman Mangal, and Neha Kumar. 2017. Care as a Resource in Underserved Learning Environments. *Proc. ACM Hum.-Comput. Interact.* 1, CSCW, Article 104 (Dec. 2017), 22 pages. https://doi.org/10.1145/3134739

[45] Elizabeth Kaziunas, Mark S Ackerman, Silvia Lindtner, and Joyce M Lee. 2017. Caring through Data: Attending to the Social and Emotional Experiences of Health Datafication. In *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing (CSCW '17)*. Association for Computing Machinery, New York, NY, USA, 2260–2272. https://doi.org/10.1145/2998181.2998303

[46] Elizabeth Kaziunas, Michael S Klinkman, and Mark S Ackerman. 2019. Precarious Interventions: Designing for Ecologies of Care. *Proc. ACM Hum.-Comput. Interact.* 3, CSCW (Nov. 2019), 27 pages. https://doi.org/10.1145/3359215

[47] Jackson A Killian, Marie Charpignon, Bryan Wilder, Andrew Perrault, Milind Tambe, and Maimuna S Majumder. 2020. Evaluating COVID-19 lockdown and business-sector-specific reopening policies for three US states. (May 2020), 6 pages. http://dx.doi.org/10.2139/ssrn.3598744 Available at SSRN.

[48] Ben Kirshner. 2009. "Power in numbers": Youth organizing as a context for exploring civic identity. *Journal of Research on Adolescence* 19, 3 (2009), 414–440.

[49] John P. Kretzmann and John L. McKnight. 1993. Introduction to Building Communities from the Inside Out: A Path Toward Finding and Mobilizing a Community's Assets. In *Building Communities from the Inside Out: A Path Toward Finding and Mobilizing a Community's Assets*. Institute for Policy Research, Evanston, IL, 1–11.

[50] Max Krüger, Anne Weibert, Debora de Castro Leal, Dave Randall, and Volker Wulf. 2021. "What is the Topic of the Group, Please?" On Migration, Care and the Challenges of Participation in Design. *Proc. ACM Hum.-Comput. Interact.* 5, CSCW2 (Oct. 2021), 29 pages. https://doi.org/10.1145/3476050

[51] John Law. 2002. *Aircraft stories: Decentering the object in technoscience.* Duke University Press, Durham, NC.

[52] Charlotte P Lee, Paul Dourish, and Gloria Mark. 2006. The human infrastructure of cyberinfrastructure. In *Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work*. Association for Computing Machinery, New York, NY, USA, 483–492.

[53] Charlotte P Lee and Kjeld Schmidt. 2018. A Bridge Too Far?: Critical Remarks on the Concept of "Infrastructure" in Computer-Supported Cooperative Work and Information Systems. , 0 pages. https://doi.org/10.1093/oso/9780198733249.003.0006

[54] Fangfan Li, Arian Akhavan Niaki, David Choffnes, Phillipa Gill, and Alan Mislove. 2019. A large-scale analysis of deployed traffic differentiation practices. In *Proceedings of the ACM Special Interest Group on Data Communication (SIGCOMM '19)*. Association for Computing Machinery, New York, NY, USA, 130–144. https://doi.org/10.1145/3341302.3342092

[55] Maria Elizabeth Loades, Eleanor Chatburn, Nina Higson-Sweeney, Shirley Reynolds, Roz Shafran, Amberly Brigden, Catherine Linney, Megan Niamh McManus, Catherine Borwick, and Esther Crawley. 2020. Rapid Systematic Review: The Impact of Social Isolation and Loneliness on the Mental Health of Children and Adolescents in the Context of COVID-19. *Journal of the American Academy of Child & Adolescent Psychiatry* 59, 11 (Nov. 2020), 1218–1239.e3. https://doi.org/10.1016/j.jaac.2020.05.009

[56] D Adam Long and Douglas D Perkins. 2007. Community social and place predictors of sense of community: A multilevel and longitudinal analysis. *Journal of Community Psychology* 35, 5 (July 2007), 563–581. https://doi.org/10.1002/jcop.20165

[57] Thomas Ludwig, Volkmar Pipek, and Peter Tolmie. 2018. Designing for Collaborative Infrastructuring: Supporting Resonance Activities. *Proc. ACM Hum.-Comput. Interact.* 2, CSCW (Nov. 2018), 29 pages. https://doi.org/10.1145/3274382

[58] Yao Lyu and John M. Carroll. 2024. "Because Some Sighted People, They Don't Know What the Heck You're Talking About:" A Study of Blind Tokers' Infrastructuring Work to Build Independence. *Proc. ACM Hum.-Comput. Interact.* 8, CSCW1, Article 20 (apr 2024), 30 pages. https://doi.org/10.1145/3637297

[59] Kirsti Malterud, Volkert Dirk Siersma, and Ann Dorrit Guassora. 2015. Sample Size in Qualitative Interview Studies: Guided by Information Power. *Qualitative Health Research* 26, 13 (Nov. 2015), 1753–1760. https://doi.org/10.1177/1049732315617444

[60] Abbey R Masonbrink and Emily Hurley. 2020. Advocating for Children During the COVID-19 School Closures. *Pediatrics* 146, 3 (Sept. 2020), e20201440. https://doi.org/10.1542/peds.2020-1440

[61] Jessica Mcclearn, Rikke Bjerg Jensen, and Reem Talhouk. 2024. Security Patchworking in Lebanon: Infrastructuring Across Failing Infrastructures. *Proc. ACM Hum.-Comput. Interact.* 8, CSCW1, Article 120 (apr 2024), 26 pages.

https://doi.org/10.1145/3637397

[62] David W McMillan and David M Chavis. 1986. Sense of community: A definition and theory. *Journal of Community Psychology* 14, 1 (Jan. 1986), 6–23. https://doi.org/10.1002/1520-6629(198601)14:1<6::AID-JCOP2290140103>3.0.CO;2-I

[63] Amanda Meng, Carl DiSalvo, and Ellen Zegura. 2019. Collaborative Data Work Towards a Caring Democracy. *Proc. ACM Hum.-Comput. Interact.* 3, CSCW, Article 42 (Nov. 2019), 23 pages. https://doi.org/10.1145/3359144

[64] Michelle Murphy. 2015. Unsettling care: Troubling transnational itineraries of care in feminist health practices. *Social Studies of Science* 45, 5 (July 2015), 717–737. https://doi.org/10.1177/0306312715589136

[65] Abeiene Nejar. 2017. *What's Love Got To Do With Research?* UX Collective. Retrieved September 7, 2021 from https://uxdesign.cc/whats-love-got-to-do-with-research-c31fc7f92221

[66] Nel Noddings. 2013. *Caring: A Relational Approach to Ethics and Moral Education*. University of California Press, Berkeley and Los Angeles, CA.

[67] Patricia Obst and Jana Stafurik. 2010. Online we are all able bodied: Online psychological sense of community and social support found through membership of disability-specific websites promotes well-being for people living with a physical disability. *Journal of Community & Applied Social Psychology* 20, 6 (Nov. 2010), 525–531. https://doi.org/10.1002/casp.1067

[68] Patricia Obst, Lucy Zinkiewicz, and Sandy G Smith. 2002. Sense of community in science fiction fandom, Part 1: Understanding sense of community in an international community of interest. *Journal of Community Psychology* 30, 1 (Jan. 2002), 87–103. https://doi.org/10.1002/jcop.1052

[69] The Council of State Governments. n.d. *2020 – 2021 Executive Orders*. The Council of State Governments. Retrieved Feb 1, 2024 from https://web.csg.org/covid19/executive-orders/

[70] Center on Budget and Policy Priorities. 2022. *Tracking the COVID-19 Economy's Effects on Food, Housing, and Employment Hardships*. Center on Budget and Policy Priorities. Retrieved Feb 18, 2024 from https://www.cbpp.org/research/poverty-and-inequality/tracking-the-covid-19-recessions-effects-on-food-housing-and

[71] Anna M Parenteau, Chase J Boyer, Lillian J Campos, Angelica F Carranza, LillyBelle K Deer, Dana T Hartman, Julie T Bidwell, and Camelia E Hostinar. 2022. A review of mental health disparities during COVID-19: Evidence, mechanisms, and policy recommendations for promoting societal resilience. *Development and Psychopathology* 35 (2022), 1–22. Issue 4. https://doi.org/10.1017/S0954579422000499

[72] Xuequan Elsie Peng and Chima Simpson-Bell. 2022. Assessing the Impact of Business Closures on COVID-19 Outcomes. *IMF Working Papers* 2022, 139 (2022), 34 pages.

[73] N Andrew Peterson, Paul W Speer, and David W McMillan. 2008. Validation of A brief sense of community scale: Confirmation of the principal theory of sense of community. *Journal of Community Psychology* 36, 1 (Jan. 2008), 61–73. https://doi.org/10.1002/jcop.20217

[74] Thomas F Pettigrew and Linda R Tropp. 2006. A meta-analytic test of intergroup contact theory. , 751–783 pages. https://doi.org/10.1037/0022-3514.90.5.751

[75] Volkmar Pipek and Volker Wulf. 2009. Infrastructuring: Toward an integrated perspective on the design and use of information technology. *Journal of the Association for Information Systems* 10, 5 (2009), 1.

[76] Karen J Prager, Doris O Fuller, and Antonio S Gonzalez. 1989. The function of self-disclosure in social interaction. *Journal of Social Behavior & Personality* 4 (1989), 563–580.

[77] Nic Querolo, Henry Goldman, and Maria Elena Vizcaino. 2021. *Struggling New Yorkers Tasted Free Wi-Fi — Until the Bills Came*. Federal Communications Commission. Retrieved April 2, 2024 from https://www.bloomberg.com/news/articles/2021-02-08/struggling-new-yorkers-tasted-free-wi-fi-until-the-bills-came?embedded-checkout=true

[78] Julian Rappaport. 1977. *Community psychology: Values, research, and action*. Holt, Rinehart and Winston, New York, NY, USA.

[79] Albert E Roark and Hussein S Sharah. 1989. Factors Related To Group Cohesiveness. *Small Group Behavior* 20, 1 (Feb. 1989), 62–69. https://doi.org/10.1177/104649648902000105

[80] Stephen Roll and Michal Grinstein-Weiss. 2020. *Did CARES Act benefits reach vulnerable Americans? Evidence from a national survey*. The Brookings Institution. Retrieved Feb 18, 2024 from https://www.brookings.edu/articles/did-cares-act-benefits-reach-vulnerable-americans-evidence-from-a-national-survey/

[81] Robert P Rugel. 1987. Achieving Congruence in Tavistock Groups: Empirical Findings and Implications for Group Therapy. *Small Group Behavior* 18, 1 (Feb. 1987), 108–117. https://doi.org/10.1177/104649648701800107

[82] Darley Sackitey, Teresa K O'Leary, Michael Paasche-Orlow, Timothy Bickmore, and Andrea G Parker. 2023. "Everyone is Covered": Exploring the Role of Online Interactions in Facilitating Connection and Social Support in Black Churches. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23)*. Association for Computing Machinery, New York, NY, USA, 17 pages. https://doi.org/10.1145/3544548.3581324

[83] Sascha Segan. 2021. *Is My Cell Phone Carrier Throttling My Speed?* PC Magazine. Retrieved April 2, 2024 from https://www.pcmag.com/news/is-my-cell-phone-carrier-throttling-my-speed

[84] Bryan Semaan. 2019. 'Routine infrastructuring' as 'building everyday resilience with technology' when disruption becomes ordinary. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 24 pages. https://doi.org/10.1145/3359175

[85] Bryan Semaan and Gloria Mark. 2011. Technology-Mediated Social Arrangements to Resolve Breakdowns in Infrastructure during Ongoing Disruption. *ACM Trans. Comput.-Hum. Interact.* 18, 4 (Dec. 2011), 21 pages. https://doi.org/10.1145/2063231.2063235

[86] Miguel Sicart and Irina Shklovski. 2020. 'Pataphysical Software: (Ridiculous) Technological Solutions for Imaginary Problems. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference (DIS '20)*. Association for Computing Machinery, New York, NY, USA, 1859–1871. https://doi.org/10.1145/3357236.3395526

[87] Susan Leigh Star. 1990. Power, Technology and the Phenomenology of Conventions: On being Allergic to Onions. *The Sociological Review* 38, 1_suppl (May 1990), 26–56. https://doi.org/10.1111/j.1467-954X.1990.tb03347.x

[88] Susan Leigh Star and Karen Ruhleder. 1996. Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces. *Information Systems Research* 7, 1 (March 1996), 111–134. https://doi.org/10.1287/isre.7.1.111

[89] Emily Stewart. 2020. *America's monopoly problem, explained by your internet bill.* Vox Media. Retrieved Feb 18, 2024 from https://www.vox.com/the-goods/2020/2/18/21126347/antitrust-monopolies-internet-telecommunications-cheerleading

[90] Katricia Stewart and Greg Townley. 2020. How Far Have we Come? An Integrative Review of the Current Literature on Sense of Community and Well-being. *American Journal of Community Psychology* 66, 1-2 (Sept. 2020), 166–189. https://doi.org/10.1002/ajcp.12456

[91] Sheryl Gay Stolberg. 2020. *At Senate Hearing, Government Experts Paint Bleak Picture of the Pandemic.* New York Times. Retrieved Feb 18, 2024 from https://www.nytimes.com/2020/05/12/us/politics/coronavirus-dr-fauci-robert-redfield.html

[92] Charlotte Tang, Yunan Chen, Bryan C Semaan, and Jahmeilah A Roberson. 2015. Restructuring Human Infrastructure: The Impact of EHR Deployment in a Volunteer-Dependent Clinic. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing (CSCW '15)*. Association for Computing Machinery, New York, NY, USA, 649–661. https://doi.org/10.1145/2675133.2675277

[93] The New York Times. 2022. *How George Floyd Died, and What Happened Next.* The New York Times. Retrieved July 4, 2023 from https://www.nytimes.com/article/george-floyd.html

[94] Joan Tronto. 1993. *Moral boundaries: A political argument for an ethic of care.* Routledge, New York, NY.

[95] Joan C Tronto. 2013. *Caring Democracy: Markets, Equality, and Justice.* New York University Press, New York and London.

[96] Janet Vertesi. 2014. Seamful Spaces: Heterogeneous Infrastructures in Interaction. *Science, Technology, & Human Values* 39, 2 (2014), 264–284. https://doi.org/10.1177/0162243913516012

[97] Russell M Viner, Elizabeth M Ozer, Simon Denny, Michael Marmot, Michael Resnick, Adesegun Fatusi, and Candace Currie. 2012. Adolescence and the social determinants of health. *The Lancet* 379, 9826 (2012), 1641–1652. https://doi.org/10.1016/S0140-6736(12)60149-4

[98] Vasillis Vlachokyriakos, Clara Crivellaro, Pete Wright, and Patrick Olivier. 2018. Infrastructuring the Solidarity Economy: Unpacking Strategies and Tactics in Designing Social Innovation. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18)*. Association for Computing Machinery, New York, NY, USA, 1–12. https://doi.org/10.1145/3173574.3174055

[99] Jack Wilkinson. 2015. *Love Letter and Break Up Letter.* Parsons Transdisciplinary Design program. Retrieved September 7, 2021 from http://dlrtoolkit.com/love-letter-and-break-up-letter/

[100] Pamela Winston. 2021. *COVID-19 and Economic Opportunity: Unequal Effects on Economic Need and Program Response.* U.S. Department of Health & Human Services. Retrieved Feb 18, 2024 from https://aspe.hhs.gov/sites/default/files/private/pdf/265391/covid-19-human-service-response-brief.pdf

[101] Marisol Wong-Villacres, Carl DiSalvo, Neha Kumar, and Betsy DiSalvo. 2020. Culture in Action: Unpacking Capacities to Inform Assets-Based Design. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–14. https://doi.org/10.1145/3313831.3376329

[102] Marisol Wong-Villacres, Aakash Gautam, Deborah Tatar, and Betsy DiSalvo. 2021. Reflections on Assets-Based Design: A Journey Towards A Collective of Assets-Based Thinkers. *Proc. ACM Hum.-Comput. Interact.* 5, CSCW2 (Oct. 2021), 32 pages. https://doi.org/10.1145/3479545

[103] Marisol Wong-Villacres, Cristina M. Velasquez, and Neha Kumar. 2017. Social Media for Earthquake Response: Unpacking Its Limitations with Care. *Proc. ACM Hum.-Comput. Interact.* 1, CSCW, Article 112 (Dec. 2017), 22 pages. https://doi.org/10.1145/3134747

[104] Jiachuan Wu, Savannah Smith, Mansee Khurana, Corky Siemaszko, and Brianna DeJesus-Banos. 2020. *Stay-at-home Orders Across the Country.* NBC News. Retrieved July 4, 2023 from https://www.nbcnews.com/health/health-news/here-are-stay-home-orders-across-country-n1168736

[105] Ying Xu and Carleen Maitland. 2017. Mobilizing assets: Data-driven community development with refugees. In *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development*. Association for Computing Machinery, New York, NY, USA, 1–12.

[106] Matin Yarmand, Jaemarie Solyst, Scott Klemmer, and Nadir Weibel. 2021. "It Feels Like I Am Talking into a Void": Understanding Interaction Gaps in Synchronous Online Classrooms. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI '21)*. Association for Computing Machinery, New York, NY, USA, 9 pages. https://doi.org/10.1145/3411764.3445240

[107] Leon Yin and Aaron Sankin. 2022. *Poor, less white US neighborhoods get worst internet deals*. The Associated Press. Retrieved Feb 19, 2024 from https://apnews.com/article/broadband-internet-speed-inequality-01a99247a08b355e89cc54595aecdafa

[108] Zoom. 2023. *Zoom system requirements: Windows, macOS, Linux*. Zoom Video Communications, Inc. Retrieved Jan 29, 2024 from https://support.zoom.com/hc/en/article?id=zm_kb&sysparm_article=KB0060748&clreqid=ea5b3868-8bcf-43ef-bb82-9fee2f55ed47&kbid=151951