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Research and Applications

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Perspectives of community-based organizations on digital health equity interventions: a key informant interview study

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Abstract

Background: Health and healthcare are increasingly dependent on internet and digital solutions. Medically underserved communities that experience health disparities are often those who are burdened by digital disparities. While digital equity and digital health equity are national priorities, there is limited evidence about how community-based organizations (CBOs) consider and develop interventions.

Methods: We conducted key informant interviews in 2022 purposively recruiting from health and welfare organizations engaged in digital equity work. Nineteen individuals from 13 organizations serving rural and/or urban communities from the local to national level participated in semi-structured interviews via Zoom regarding their perspectives on digital health equity interventions. Directed content analysis of verbatim interview transcripts was conducted to identify themes.

Results: Themes emerged at individual, organizational, and societal levels. Individual level themes included potential benefits from digital health equity, internet access challenges, and the need for access to devices and digital literacy. Organizational level themes included leveraging community assets, promising organizational practices and challenges. For the societal level, the shifting complexity of the digital equity ecosystem, policy issues, and data for needs assessment and evaluation were described. Several example case studies describing these themes were provided.

Discussion and conclusion: Digital health equity interventions are complex, multi-level endeavors. Clear elucidation of the individual, organizational, and societal level factors that may impact digital health equity interventions are necessary to understanding if and how CBOs participate in such initiatives. This study presents unique perspectives directly from CBOs driving programs in this new arena of digital health equity.

Key words: digital equity; health equity; consumer health informatics; community engagement; socioecological model.

Introduction

Health and healthcare are increasingly dependent on the internet and digital solutions. However, low-income, racial and ethnic minoritized, and rural communities face digital inequities.[1] Digital equity is the information technology capacity of individuals and communities to fully participate in society and the economy.[2] Barriers to digital equity include multi-level factors such as: policies from the federal to the local levels that impact internet availability and affordability,[3] infrastructure barriers due to geography or the built environment,[4,5] and practices by technology and internet companies that lead the intentional lack of investment in broadband availability in low-income areas and communities of color (also called digital redlining).[6] Addressing these digital equity barriers is a national priority; the US federal government launched the Internet for All program enabled by the Digital Equity Act that supports infrastructure deployment, skills training and access to technologies including high speed internet for everyone in the country with focus on populations who are underserved including low-income communities, older adults, racial and ethnic minoritized communities, rural inhabitants, or communities best served by languages other than English.[7,8]

Broadband access is a social determinant of health.[9] Thus, digital equity is a prerequisite for digital health equity, which is defined as having access to digital healthcare, appropriate design of solutions, and benefits and outcomes of digital health experiences.[10] Digital health solutions that have been designed with inadequate attention to potential racial bias or disparities have led to differential performance of medical devices,[11] artificial intelligence,[12] and informatics interventions.[13] During the COVID-19 pandemic, those in racial and ethnic minority groups and with low income levels generally experienced greater barriers to telehealth use compared to White and high income groups,[14] with variation in telehealth use by reason for seeking telehealth,[13] race,[15] and the intersection of race and gender,[16,17] highlighting the complexity and nuance needed in digital health equity work. Community efforts to address these disparities in telehealth were rapidly initiated across the United States.[18]

Development of real-world interventions to support digital health equity—solutions or programs involving digital

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technologies and related data implemented for the purpose of health equity—are complex undertakings.[19,20] This is particularly true for small community-based organizations (CBOs) which are defined as entities representative of a community that provide services to members of the community.[21] A variety of organizations may be involved in digital health equity work including health care and social needs providers,[22–25] affordable housing,[26] and the technology industry.[27] Others serve as anchor institutions in providing broadband access to communities: public libraries,[28,29] schools,[30,31] advocacy organizations,[32] For example, social and senior services organizations have provided computer training and health classes to community members they support,[33,34] and coalitions have mobilized to support digital access for K-12 students.[35] There is emerging attention to the implementation and evaluation capacity of CBOs which is critical to addressing health equity.[36,37] While several studies have focused on participants' experiences with digital health equity interventions.[38–40] there remains little literature specific to digital health capacity among CBOs. One CBO study about transitioning an in-person fall prevention program to remote during COVID-19 suggested that identification of staff technology support needs and rapid implementation of new strategies were critical.[41]

There are a few examples of tools and guides for states[42,43] and schools[44] that introduce the challenges of digital equity and suggest strategies to consider, but there is a lack of such resources specific digital health equity. The sociotechnical considerations for health information technology (IT) are different than for other contexts due to the clinical content of data, regulatory requirements, and critical nature of patient care.[45]

Frameworks have been developed to help understand the multifaceted digital health equity ecosystem.[46,47] Among these, the Socioecological Model (SEM) is a commonly applied theoretical model to explain the interplay of interpersonal, organization, community, societal, and environmental interactions and how those interactions impact human health systems.[48] With this perspective of accounting for dynamic contextual factors, rather than taking an individual-focus perspective, the SEM helps identify and evaluate programs or interventions to support health. Recently, an explanatory Framework for Digital Health Equity was proposed by Richardson and colleagues, building on National Institute on Minority Health and Health Disparities' (NIMHD) Research Framework[49] and SEM defined a new construct, the digital environment—conditions in the digital environment that affect a wide range of health, functional, and quality of life outcomes and risks—as a cross-cutting domain across SEM levels.[10] Lyles et al[50] suggest determinants that influence digital health equity aligned with SEM including policy, healthcare system, community/social relationships, individual, and add an intervention level. They offer examples of intervention strategies at different levels such as community co-design, individual digital literacy support, and specific programs for safety net settings.

While these digital health equity frameworks offer a high-level conceptual understanding of the digital health equity ecosystem, the nascent field has not yet operationalized these frameworks to guide CBOs' activities in planning, implementing, and evaluating interventions. There remains limited knowledge about the specific factors that impact CBOs ability to design and deliver digital and health equity interventions.[51–53] This lack of guidance threatens the capacity to fulfill the national priority of achieving digital health equity. Therefore, the purpose of this study was to address this gap in knowledge of the factors affecting digital health equity intervention development and implementation from the CBO perspective. We conducted a key informant interview study with the specific aim to understand the CBOs' experiences with development and implementation of digital health equity interventions including goals, successes, challenges; and to uncover potential factors from these real-world experiences that may affect the CBO's ability to develop or implement such programs.

Methods

This cross-sectional, descriptive study was conducted August-September 2022 in the United States with key informants from local, regional, state, or national organizations involved in digital health equity work. We developed a semi-structured interview guide informed by the Socioecological Model and the authors' extensive experience in pragmatic program implementation.[54] The interview guide included topics related to the mission of the organization, challenges to digital health equity, organizational and community assets and barriers to address challenges, gaps and opportunities, and measures of effectiveness. Informants' roles were captured as these are relevant to intervention development. However, demographic information such as race and ethnicity of informants was not recorded as there was no intent to relate individual characteristics with responses about organizational faactors.[55]

We purposively recruited key informants from CBOs concerned with health equity among some of the target populations identified for the national Digital Equity Act investment: people who are low-income, older adults, racial and ethnic minorities, rural inhabitants, or have language barriers.[8] We recruited from our professional networks and employed snowball sampling to identify at least two of each group. We assessed CBO eligibility by reviewing organizations' websites and asking participants to describe the CBO's mission. The interviews were conducted by one or both authors in a 60-min video call. Interview recordings were used to generate transcripts which were de-identified prior to analysis.

We applied qualitative directed content analysis, in which previous theory and research are applied deductively to identify common themes across the interviews.[56] We used publications on existing digital equity resources and interventions at the community level (eg, Refs. 50, 57) to develop an initial codebook which was then inductively iterated based on the interview text. One researcher created an initial codebook and coded 3 interview transcripts. A subset of transcript text randomly selected using a random number generator was then coded by two coders independently (double coding). After each round of double coding, the coders met to compare codes, discuss, and resolve any discrepancies in coding, and make any updates to the codebook. Inter-rater reliability (IRR) was calculated after each round, with additional rounds of double coding to achieve 80% or more indicating good agreement between coders.[58] IRR of 79% was achieved after 3 rounds of coding and, after discussion of coding disagreements, we reached 100% agreement. The remaining transcripts were coded independently. The research team met

to review the final coding to identify any additional insights about the codes and their relationships with each other based on previous research. The codes that emerged were then organized by the levels of the SEM.[48] This study was deemed non-human subjects research by the MITRE Institutional Review Board.

Results

We interviewed 19 people from 13 organizations in the United States. Among the informants were 10 who held senior leadership positions; 1 was in information technology, 3 service line directors, 1 research director, 3 with roles in a digital equity program. The organizations varied in the type of services provided—4 in senior services, 3 in health, 3 in digital equity, and 3 in other non-medical services including social services and housing—and service area—10 were located in the West Coast, and 1 each in 3 other states. Eleven had local or regional focus while 1 was state-level and the other national. Only 3 organizations had a mission that specifically emphasizes digital equity. Most of the organizations had considered developing interventions; 10 organizations had delivered them, 4 had not yet implemented an intervention. Several organizations shared examples of interventions that they had developed and these are summarized in Boxes 1–3. Themes that emerged from the interview data and organized by individual, organizational, and societal levels are described below and provided in Tables 1-3. Attributions to illustrative quotes use participant identifiers (eg, P01) with the type of CBO the informant was representing in the interviews.

Individual level themes

There were 3 major individual level themes: potential community member benefits from digital health equity, internet access challenges, and Internet as necessary but not sufficient. The themes, subthemes, and illustrative quotes are provided in Table 1. Participants noted that digital health equity may benefit the community in terms of access to healthcare, access to non-medical services that improve health and wellness, and as a lever to build community relationships. Internet availability and access was essential to digital health equity but there are numerous barriers to universal access, including a lack of reliable service providers and infrastructure in underserved communities including rural geographies and challenges in signing up for affordable internet services.

Participants said that internet access alone was not sufficient to achieve digital equity. Community members have concerns about the lack of trust in digital services and providers. This lack of trust may be attributed to bias and other mechanisms of marginalization that impacted the daily lives of community members such as those who speak languages other than English, racial and ethnic minority groups, and older adults and may have contributed to fears when signing up for government programs, as seen by P01 (coalition of health centers), P11 (rural community health center), and P12 (rural and urban safety net services).

Organizational level themes

There were 3 major organization level themes: community organization practices, community assets, and organizational challenges (see Table 2). Participants described organizational practices they thought had been effective in achieving their digital health equity objectives including planning for comprehensive interventions to address multiple, interrelated needs, including supporting internet and device access, digital literacy training, technical support, and other needs. Organizations matched connectivity options with community needs, availability constraints, and opportunities. In order to effectively and efficiently enact digital equity interventions, participants identified the need for partnerships, especially when internal capacity was limited or organizations wanted to avoid duplicating services. Some participants noted how partnerships shifted with changing needs, which was particularly evident during the COVID-19 pandemic.

It was noted that community members and CBOs have assets that can be deployed in in support of digital health equity including understanding of the community. For example, P04 (local senior housing) and P13 (regional community

Box 1. iPads for older adults: a regional all-inclusive senior services organization implements an intervention supporting medical and non-medical needs of older adults via an iPad-based medical and socialization intervention.

Medically complex and frail older adults who were supported by the senior services organization were in need of medical and non-medical services while isolated during the COVID-19 pandemic. After assessing internal capabilities and financial impacts, the organization partnered with a utility agency to deploy iPads that could connect to WIFI to access telehealth, socialization, and other services through the organization. To support internet access, the organization connected older adults with the Affordable Connectivity Program for access at home and provided internet access at center sites when they were able to come back in person. Understanding that older adults also needed digital literacy training, technical support, and linguistically inclusive devices, the organization found a community partner to deliver training, provided support via their in-house IT team, and chose iPads to distribute because, "*very easily you can switch it to a different language. That's one of the reasons why we chose the iPads…it significantly help folks, because now they have a whole new world to participate in now they have iPads and Internet access*" (P09 regional senior services). The organization chose a partner to deliver training instead of doing it themselves because "*that's their competency… I'm not sure it makes sense for us to build that capability the training…say, 'Okay, I'm gonna hire a person just to navigate all these programs'… that doesn't seem to make the business sense, and the best use of our Medicare and Medicaid dollars*" (P09 regional senior services). While the program was successful, there were challenges, such as the strain on the small IT department to provide technical support including helping older adults sign up for the FCC program: "*that was a struggle. I mean we just had to work with for hours sometimes*" (P09 regional senior services). With the waning of the pandemic, the iPads were being used primarily for socialization and accessing some classes. The organization would like to build in more integrated and comprehensive opportunities for older adults via the iPad, like remote patient monitoring, that is affordable and fits within current regulations.

Box 2. Internet for telehealth: a community health center tackles the challenges of expanding internet access in rural communities to enable telehealth.

Many rural community members faced transportation and time constraints seeking medical care. To address this need, a rural community health center serving migrant farm workers and people experiencing homelessness sought to expand internet access by themselves, finding that there were no partners available at the time that could support this effort. The health center assessed existing internet providers and delivery options, such as working with telecom companies to lay broadband cables and or set up cell towers. During this assessment, they found that there were few service providers available and many of the local communities lacked any internet at all. This was particularly challenging for migrant farm workers who lived in housing provided by farm owners; therefore, any options for workers required the collaboration of the farm owners. The health center considered both engaging with a telecom company to lay broadband cable or putting up a tower to expand cellular service, "*but it was just so complicated and none of us are like experts in that field.*" (P11 rural community health center). They did find success supporting patients experiencing homelessness after receiving a telehealth grant for "*purchasing about 25 phones with service plans, so that they could connect with case managers and their healthcare provider. But it's very expensive and complicated to do that…service ends in April 2023, and at that point you can keep the phone, and then you can enroll in your own service plan. So, I think it's still helpful because they at least don't need to purchase the phone themselves. But two people have already lost their phones and there's a location tracker, and we're trying to help them locate it, but that can be its own project on its own*" (P11 rural community health center). At the time of the interview, the community health center was still facing challenges and had identified a new potential partner who was "*gonna be more focused on non-health issues, and I could see them potentially being a better fit to do this. But we haven't approached them yet since it started just a couple of months ago. I don't wanna add things to their list.*" (P11 rural community health center).

Box 3. Public WIFI partnership: a partnership between a safety net organization and a county agency to act as an anchor organization for public WIFI.

Rural and urban communities served by a safety net organization faced barriers to accessing the internet, especially in rural areas and congregate housing. The county in which they operated had been working to expand public WIFI through putting up towers throughout the county, especially more remote areas. The county approached the safety net organization and offered to put a tower on their building. The organization agreed and now people who are in or around the building can get free WIFI provided by the county. The operational and technical impact on the organization had been minimal because it only provides space for the tower: "*we don't touch it*" (P12, urban and rural safety net services). However, they would not have known about their ability to support community internet in that way if they had not been contacted by the county agency.

organization) noted the importance of building that existing knowledge and skills through partnering with community members who provide support back to their own communities. Existing relationships were noted by many participants as being a key asset for their organization and the community. Trust was already established with these partnering organization and allowed for efficient collaboration given many of these organizations are already engaged in work that support various aspects of digital health equity, such as anchor institutions for connectivity, like public libraries and public-school districts. These institutions are established centers for internet access, running programs to provide hotspots, as mentioned by P11 (rural community health center), or providing digital literacy training, as stated by P13 (regional community organization). Having an established IT team and staff with experience and success developing and funding digital health equity initiatives were also critical assets.

Many participants noted organizational challenges based on experience in implementing digital health equity programs. One challenge was having adequate internal capacity to develop, deploy, and manage digital equity interventions. This included lack of staff who were knowledgeable about connectivity and internet access resources. Some participants noted challenges partnering with telecom and other organizations to expand internet access. Informants also noted issues in identifying and obtaining funding for both starting digital health programs and sustaining them, often learning about funding opportunities through informal channels (eg, by a staff member being on a task force that discusses funding, someone compiling and emailing a list of opportunities in their free time). Intervention sustainability as a whole was a challenge; for some organizations, there were additional challenges in meeting funder requirements or restrictions on how digital equity programs could be run.

Societal level themes

There were 3 major societal level themes: shifting complexity of the digital equity ecosystem, policy issues, and data for needs assessment and evaluation (see Table 3). Policy was seen as key to various aspects of digital health equity that 3 organizations were directly involved in policy advocacy; P01 health center coalition and P15 aging coalition engage in state-level advocacy on behalf of the counties they represent, while P05 and P15's organization engages in federal-level advocacy. Several noted that policies have led or may lead to barriers developing or implementing digital equity solutions. There were specific mentions of the COVID-19 public health emergency declaration that impacted telehealth and internet policies. Participants talked about the importance of addressing legislation and funding from the local to the federal level.

In order to understand community needs, participants reported using publicly available data such as a state digital equity report, national American Communities Survey, and Federal Communications Commission broadband maps. They also expressed concerns with these sources lacking local

Table 1. Themes regarding individual level factors related to digital health equity from key informants.

Major theme and subtheme	Illustrative quote[a]
1. Potential community member benefits from digital health equity	
1.1 Access to healthcare	• Broadband access "*has been extremely important because prior to the public health emergency, my team would be out providing home visits doing in-person assessments, and that's all changed since 2020.*" (P17 rural regional senior services organization)
1.2 Access to non-medical services that improve health and wellness	• "*. . .we were doing activities by zoom and exercise classes and rehab by zoom. So, all of those things, if you don't have a way to access that, you're missing out.*" (P08 regional senior services organization) on how the organization adapted services during the COVID-19 pandemic
1.3 Digital equity can help build community	• "*The positive impact it can have in community building and reducing isolation and connecting people to their communities, whether it be their family or their medical community, etc., resources—that to us is the result that we would want for everyone.*" (P04 local senior housing)
2. Internet access challenges	
2.1 Lack of widespread access	• "*Getting the Internet almost like a utility where everyone has access to it. . .in this day and age is just as important as any other utility.*" (P08 regional senior services organization)
2.2 Lack of reliable service providers and infrastructure	• "*Access to resources and vendors is difficult up there, so we would have to send people from five hours up.*" (P04 local senior housing)
	• "*At the farm worker dormitories there's no actual Internet cable laid. So even if they were willing to pay for it or if there's some organization that would pay for it, they would have to build out the cable and lay it all the way there. . . so we were thinking, maybe we could get a hotspot. But then we were looking at the FCC maps of service. . .there would just be one service company that provides service. . .and would the signal be strong enough to support video calls.*" (P11 rural community health center)
	• "*There are some areas in the mountain where you won't get a signal at all on your cell phone*" (P17 rural regional senior services organization)
2.3 Challenges in signing up for internet services	• Signing up for the Affordable Connectivity Program (national affordable internet offered through private service providers) "*. . .is cumbersome and time consuming*" (P09 regional senior services organization)
	• "*Dealing directly with some of the providers trying to get that discount rate at times could be very challenging, and you have to be very persistent and I'm talking that from experience with some of our clients where here's this opportunity, but it's not as simple as it is stated on paper.*" (P12 rural and urban safety net services) regarding migratory and seasonal agricultural workers.
	• "*The construction is different in every community. Some have concrete, you know, blocks several stories up, and then others are a little more malleable which meant that some places in some buildings had gaps in WIFI coverage, necessitating embedding the actual routers all throughout the community and so that there was consistency*" (P04 local senior housing)
2.4 Affordability of internet	• "*Affordability impacts even more households than availability does. . .and impacts them regardless of where they live—urban, rural, suburban, tribal. . .*" (P05 national digital equity organization)
2.5 Other life priorities	• "*. . .something they're gonna choose if they've got to make a decision between broadband and food or a prescription. . .are you gonna make that decision to choose from over your basic necessities?*" (P08 regional senior services organization)
3. Internet as necessary but not sufficient	
3.1 Additional needs beyond internet	• "*. . .the Internet is the first step, and we have to be aware that there's more things that are coming. . .should also give you a device.*" (P12 urban and rural safety net services)
3.2 Right device that meet the needs of community members	• "*The right device for their needs is another barrier. You might have Internet access, but you're limited to your mobile phone o then you can't accomplish the things you need to accomplish . . .*" (P05 national digital equity organization)
3.3 Digital literacy and technical support that meet the diverse cultural and linguistic needs	• "*. . .we've got extremely diverse cultural individuals with different backgrounds, different languages, that also need training tools, accessible applications where they can understand how to utilize these tools with the access to broadband.*" (P04 local senior housing)
3.4 Trust in the digital services and providers	• This lack of trust may be attributed to "*. . .what has been taken from us through colonization*" (P13, regional community organization).
	• "*To use some of these platforms, you have to give over so much your identity, and for many of our patients that's a non-negotiation. . .they are super anxious about deportation. . . folks actively choosing not to participate because that feels like a privacy issue. . .our patients might have trust issues, but that's because the police sweep the neighborhood and arrest them. I feel it's very well founded. I don't think of that as a trust issue as much as self-preservation.*" (P18 urban network of community health centers)
3.5 Fear when signing up for government programs	• "*We've heard about the government's initiative to provide Internet to everyone. But for our population, the fact that they ask you for a social security number, or some other specific information, it's kind of already a barrier, because you have some people that maybe have families that are mixed status.*" (P12 rural and urban safety net services)
3.6 Biases about people from marginalized groups	• "*There's a little bit also of an assumption that because someone is of a certain age that they don't have any desire or the capability to utilize technology, and we find every day that is just not true. . .there's a desire there.*" (P08 regional senior service provider)

[a] Participant ID with description of the respective organization is provided with each quote.

Table 2. Themes regarding organizational level related to digital health equity from key informants.

Major theme and subtheme	Illustrative quote[a]
4. Community-based organization practices	
4.1 Comprehensive interventions to address multiple, inter-related needs	• "*Digital literacy demonstration project we provided every participant with a refurbished laptop at no cost, because it would be of no value for them to come to a workshop but have no equipment to use. . .then our instructors were also trained to help them sign up for the broadband access benefit. . . really made a difference.*" (P13 regional community organization)
4.2 Technical assistance	• "*. . .a one-stop shop support team. . .gonna have to be able to be multilingual.*" (P09 regional senior services) • "*. . .that elevating the peer training model was critical. . .identifying ambassadors in the community that were trusted, inspired to volunteer for their office hours. . .was really important to learn. We didn't go in thinking this. We knew that that model was successful in other areas, but we didn't know it would be here. . .that was probably more of the successful infrastructure that we identified over time*" (P04 local senior housing).
4.3 Partnerships	• "*I think partnerships are critical . . . so that doesn't feel like we have to build it all.*" (P08 regional senior services organization) • "*The library system is a big partner in any digital equity work, the housing authority system is going to be a big partner. . . the workforce system, they're all going to be big partners because they're all going to be doing some level of digital skills training. Your adult ed system is always gonna be combining digital skills training with adult literacy. . . And then you have your nonprofit community-based sector, many of who might be doing adult ed, workforce and healthcare or homelessness services or reentry services but they all see digital equity as a piece of their work.*" (P16 city-wide digital equity coalition) • "*Public libraries are just a such unbelievable hubs. Older adults use public libraries all the time.*" (P15 county-wide digital equity coalition for older adults)
4.4 Coalition building	• "*. . .there was not an entity. . .when the pandemic hit who could pull together the district all these different charter and private school systems like the city. So, the city had the ability to kind of pull the partners together and had the ability to do contracting with the ISPs in a way that would ensure the same equivalent services across every educational institution for every household in a way that a particular system or educational system might not have been able to do or wasn't able to do at that time.*" (P16 city-wide digital equity coalition)
5. Community assets	
5.1 Community capacity	• "*We really pay most attention and invest most of our time and energy in what can community do on their own and then considering what can they do with a little bit of help. . . we work to amplify that and we talk about building capacity, confidence, and courage to take action. . .and at that center core of what community can do, or what they're able to do with a little bit of help over time continues to grow and amplify and become more and more.*" (P13 regional community organization)
5.2 Intrinsic knowledge and skills within the community	• "*. . .data collection analysis, synthesis and decision making based on data that's collected is a huge part of our work. And then again, building capacity within our communities as data scientists, which is not something new. It's a part of who we are it's just reviving that practice and restoring dignity.*" (P13 regional community organization, referring to indigenous communities and their analytic traditions)
5.3 Established information technology (IT) staff	• "*What I'm very thankful for is our chief information officer was very involved. . . was able to pull the levers with our partners to ensure that we had strong WIFI broadband layered across the community.*" (P04 local senior housing organization)
5.4 Staff with experience and success developing and funding	• "W*e certainly leaned on internal resources. . .I have a strategic initiative director who also understands the whole design thinking and the has been basically spearheading innovation through technology tools for years.*" (P04 local senior housing organization)
6. Organizational challenges	
6.1 Inadequate internal capacity	• "*It was really important resource consumption of our IT folks, having to try and bridge that connectivity and help shepherd people through the process of the application.*" (P08 regional senior services) • "*We tried to sign up with the great programs. . . when they tried to apply for that, they got denied because they already had Internet I guess at some point. So we had to really fight to get them Internet again at the lower rate. . .that took a lot of time on our part to get them back online.*" (P09 regional senior services organization)
6.2 Partnering with telecom	• Having multiple health centers when each "*has their own relationships with telecom companies. You throw large corporate telecom company and the mix. . .they better be something a whole lot better than what they've got in order for them to maybe change relationships.*" (P01 collaborative of health centers) • "*At one point our program was looking into, you know, can we get a tower installed somewhere on the coast? But it was just so complicated and none of us are experts in that field. . .we did ask a few organizations, and typically what happens is when you have requests like this, certain county departments will be like well, 'that's not technically our purview.'*" (P11 rural community health center)

(continued)

Table 2. (continued)

Major theme and subtheme	Illustrative quote[a]
6.3 Identifying and obtaining funding	• "*We did receive a grant for telehealth. So we ended up purchasing about 25 phones with service plans, so that they could connect with case managers and their healthcare provider. But it's very expensive and complicated to do that. . .I think even 25 phones used half the grant money we were allotted for our homeless population for telehealth.*" (P11 rural community health center)
6.4 Sustainability	• "*One of our biggest challenges, is making sure that that sustainability exists. . .an individual might stop paying their bill or. . . just stop using it. . .There still needs to be someone there to correct that. . .is definitely something that we would love to be able to fix, but. . .we're not resources.*" (P10 regional senior services organization) • "*The way that you will get it funded in a sustainable way that does not rely on grants. . .we didn't have health navigators until we had funding from the federal government that said that you could support positions in almost every place to do health navigation.*" (P16 city-wide digital equity coalition)

[a] Participant ID with description of the respective organization is provided with each quote.

Table 3. Themes regarding societal level related to digital health equity from key informants.

Major theme and subtheme	Illustrative quote[a]
7. Shifting complexity of the digital equity ecosystem	• "*. . .been tough to navigate and really identify the best way to gain additional information. I feel like literally every time we meet with someone, we're learning about a new tool for connectivity and new capability.*" (P02 state aging organization)
8. Real-world policy implications	• "*The reason that we have not moved forward on it is because to anytime you want to put anything on facility or be able to access a facility, there's likely gonna need to be a pretty significant either RFP process or master license agreement where you're gonna have to get a lot of lawyers together to say, 'What can you do?'. . .particularly if we were gonna bring in an outside entity to run that network. 'Who can access it? When can you access it, what's the city's responsibility to maintain it?. . . it can take a lot of time to work it through in a larger city like with a enormous bureaucracy.*" (P15 city-wide digital equity coalition) • "*Telehealth became more prevalent in during the pandemic. . .But we have some restrictions around that at the Federal level that will probably end when the Public Health Emergency officially ends.*" (P08 regional senior services organization) • "W*e're actually trying to get that (need for funding) in front of the Legislature. . .*" (P08 regional senior services organization) • Need to educate federal policymakers about "*what's happening on the ground*" in digital equity (P05 national digital equity organization)
9. Data for needs assessment and evaluation	• "*We don't have useful ways of thinking about it and measuring it right now. . .figuring out how to measure all the things is a problem than just makes my head spin*" (P05 national digital equity organization)

[a] Participant ID with description of the respective organization is provided with each quote.

data and the inherent problems of using general estimates as assumptions for local conditions. Some organizations reported collecting new data using surveys and external program evaluations. Participants also recognized that the lack of standardized data at the local level hampers planning and evaluation efforts. Examples of various types of data that were important in their communities included:

- Digital Equity: eg, access and use of internet, devices, digital literacy, applications, and other technology solutions
- Digital Health Equity: eg, access and use of telehealth and other digital health solutions, healthcare utilization, health/clinical/psychosocial outcomes, caregiver health, and wellness
- Community and Population Indicators: eg, race and ethnicity, diversity within a community, community thriving (creating opportunities that encourage individual and community contribution towards community-driven solutions), independent living (vs facility living), community strength (building supports and strengths in the community)

Discussion

The multilevel findings in this study are illustrative of the complexity of the digital health equity ecosystem and how to design, develop, use, implement, and evaluate digital health equity interventions. These findings align with sociotechnical model of complex adaptive healthcare systems by Sittig and Singh, which describes 8 dimensions: technology, human-computer interface, clinical content, people, workflow and communication, organizational culture and characteristics, measurement and monitoring, and external forces must be considered altogether rather than discretely. The three brief case examples illustrate this complexity. For example, the case example in Box 2 describes how the attempt to address one particular need, internet access to allow farmworkers to use telehealth. revealed unanticipated complexities in technology, organizational characteristics people, and external forces drove substantial changes in intervention design. This CBO initially tried to install broadband infrastructure

through a partnership with a telecom which proved too difficult. They tried to simplify by buying smartphones with data plans so individuals could call case managers which then exposed another organizational-level challenge, a lack of sustainable funding source for the cost of data plans. All 3 case examples reveal that these CBOs are focused on solutions for internet access, which is a prerequisite for the health equity goals they were pursuing (eg, telehealth, social isolation, case management for older adults or rural residents), and also involve addressing additional sociotechnical factors to be successful.

We identified several important perspectives regarding how CBOs plan and implement interventions for digital health equity at the individual, organizational, and societal level factors. At the individual level, participants perceived digital health equity as contributing to access to healthcare services and non-medical services as well as building community trust, however, they noted that internet access alone was not sufficient to deliver impact. This research builds on existing efforts to systematically understand and address digital health equity. For example, while telehealth access expanded from very few services available pre-pandemic to an explosion of services available during the pandemic,[59] the benefits of access was not universal across all populations,[60,61] including accessing specialty care medical care.[62,63] One contributor could be digital redlining, with one study finding that broadband access was associated with telehealth utilization in rural populations, particularly for those who identified as Native American or Pacific Islander.[64] Expanding digital access can increase access to health care across all communities but many residents who might be willing to use digital health services do not have access.[65] Our study findings are also congruent with a recent literature review that identified challenges in virtual care equity including competing priorities, trust, inclusivity of solutions, policy and infrastructure factors, and discrimination.[66] While there are examples of new interventions to address some of these individual barriers, such as digital health navigators who can build relationships with patients and support their introduction and use of technology and health-specific tools,[67,68] the adoption of any new program may be enhanced by also integrating solutions for organizational and societal level factors that affect implementation.

At the organizational level, communities and organizations have numerous strengths that can support digital health equity, such as building on existing community partnerships and trust relationships. This perspective aligns with a proposed framework from Richardson et al[10] which recognizes resilience and strengths of the community as factors in digital health equity. Strengths were discussed by participants as a necessity given the numerous challenges to digital equity intervention development that they described. These included partnership and funding challenges. Some of these challenges may arise from differences in priorities between digital service organizations (eg, technology companies) and organizations who use services to support digital health services (eg, health care organizations). Our participants described this through the difficulties they had finding others to partner with for digital equity interventions, whether it be a telecom company or a government agency. These are poignant examples that illustrate what Lyles et al[57] describe as misalignment between the priorities between digital service organizations and their funders (eg, digital health companies, venture capitalists) and health care payers and organizations that "have stymied the progress of digital health tool uptake" by patients (p.1). These types of impacts on health equity by companies' priorities and actions are described by the World Health Organization as commercial determinants of health.[69]

Community partnerships and are acknowledged to be important for health equity.[70] Awareness of the importance of partnerships among organizations including CBOs, healthcare providers, payors, technology, and other industry, and government is evident in the heightened awareness of the role of social determinants of health (SDOH) on access, experience, and outcomes.[71,72] Access to internet for health services is arguably an SDOH.[9] There is a need for evaluation and documentation of best practices for how to implement screening, referral, and interventions for SDOH which often require holistic partnership among organizations and with community members themselves.[36,73] In a broader context, these findings similar to approaches such as community-based participatory research from public health[53,54] and participatory action research from democratic labor movements,[53] both of which emphasize that partnership among institutions and with individuals within the community of interest are critical to the relevance of any solution. Several authors have built on these traditions to describe how technology can be either an enabler or deterrent of those relationships and digital health equity.[13,53]

At the societal level, our findings highlight the shifting and complex digital health ecosystem which reflects a dynamic rather than static contexts and community relationships in which digital health interventions exist. In addition, the importance of policy decisions such as funding and regulations that can support or hamper the ability of local CBOs to build equity cannot be ignored. Organizations need to negotiate these tensions between commercial priorities and communities' needs within a policy and regulatory context. There is recognition of these tensions in digital equity, and recommendations for addressing them from the Federal Communications Commission's Communications Equity and Diversity Council[74] and the US Department of Education's report for advancing digital equity in education.[75] Yet, there is a lack of actionable guidance available for CBOs delivering digital health equity interventions. Within the body of work on digital health equity, much of the focus has been on the individual level (eg, barriers to virtual care technologies or internet)[38,76,77] or on the societal context (eg, policies that impact reimbursement for virtual care or practices that lead to digital redlining).[6] The federal funding initiatives focus on supporting individual access (eg, the Affordable Connectivity Program broadband subsidy) or providing states with funding that they then distribute (eg, Internet for All grant program). There is a gap in research and attention to the organizational level and to implementation guidance, particularly the CBOs such as those represented in this study that provide programs or are connectors of individuals with programs.

The need for guidance to CBOs on digital health equity intervention development echoes research on multilevel interventions for health disparities. For example, Purnell and colleagues who analyzed several systematic reviews highlight that lack of attention to organizations' challenges in program implementation and sustainability is a key gap in research on health disparities interventions, Ramanadhan and team report on a scoping review that identifies the need to build

CBO capacity to implement evidence based, health equity interventions.[36] Among the capacities identified were some that aligned with our findings: knowledge/expertise, resources for taking action, implementation abilities, and technology. Veinot et al's[52] multilevel health equity framework which incorporates information and communications technology calls for explicit attention to uses of technology in upstream interventions at the structural and environmental context levels which may enable greater health equity impact downstream at the individual level. Their recommendations suggest important implications for 2 themes identified in our study, strengths and assets of CBOs and power and practice of partnership. Strengthening the technology infrastructure, skills to design digital programming, and business development capacity to partner with the telecom industry for CBOs may provide the leverage to deliver digital health equity to individuals in the community.

Limitations

There are several considerations when interpreting our study findings. Our convenience sample, while adequate in number for exploratory interview studies,[78] was not evenly weighted by organization type, did not include all of the potential types of organizations that engage digital health equity work, and was recruited using our professional networks and snowball sampling. Therefore, our findings may not have captured all the potential factors impacting digital equity or be generalizable to other types of organizations. However, we included a variety of organizations and were able to identify common themes across participants, indicating strength in our methods. We did not collect demographic information about key informants, and therefore we may no assertion of representativeness of interviewees' views nor in the breadth of organizations supporting digital health equity. Lastly, our study did not focus on the individual or family member level. We did not interview individuals who directly experience digital health inequity. It is imperative that future digital equity research includes community members to systematically understand their digital health equity needs, validate framework concepts, and contribute to the development of outcome measures that are relevant to them.

Conclusions

This key informant interview study provides perspectives of CBOs on the current practices, challenges, and needs in digital health equity. The perspectives are diverse, yet highlight the multiple levels of individual, organizational, and societal issues that contribute to the complexity of planning and implementing interventions in this arena. In particular, our findings shine a spotlight on several notable concepts from the thematic results that are ripe for investigation in relation to digital health equity because they indicate the multilevel complexities that face CBOs: the shifting and complex digital health ecosystem, the strengths and assets of community organizations, and power and practice of partnership. While work is emerging in digital equity and, consequently also in digital health equity, there is substantial opportunity to enhance knowledge and actionable guidance specifically to strengthen the capacity of CBOs that are often on the front lines of creating digital equity opportunities or bridging federal programs to individuals. Further, innovation in strategies for digital health equity require matching among community needs, available digital equity solutions to meet community needs, community capacity to enact those solutions, community partners available to help enact solutions, and the policy environment. Data are key to identify those requirements; future work should include developing and validating measures, which are currently lacking. These key informant perspectives indicate the need to transform an abstracted view of digital health equity to one in which CBOs can efficiently and effectively operationalize their activities toward demonstrable digital health equity impact.

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Author contributions

K.K.K. led conceptualization of the study and its methods, co-developed the interview guide and analysis plan, participated in interviews, engaged in data analysis and interpretation, and co-authored the manuscript. U.B. co-developed the interview guide, led the interviews and analysis, engaged in interpreting the data, and co-authored the manuscript.

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Conflicts of interest

None declared.

Data availability

The data gathered for this study cannot be shared publicly due to the privacy of individuals interviewed and the organizations they represent.

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