

Engaging Identity, Assets, and Constraints in Designing for Resilience

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We contribute to the growing conversation on assets-based approaches to design in Computer-Supported Cooperative Work (CSCW) and Human-Computer Interaction (HCI) with a qualitative study of resilience. Our study is situated within a community health infrastructure in a rural county in southwest Kenya, where health organizations pay community health workers' salaries via digital payments, backdropped by ongoing issues with missing and delayed payments. Through the lens of intersectionality, we examine how community health workers of diverse backgrounds and contracted status respond to the mandated use of digital payment methods and long payment delays. We highlight how resilience in this context is situated in workers' intersecting socioeconomic and professional identities, which shape the assets and constraints that workers engage with in efforts to be resilient. We leverage our findings to discuss how assets-based approaches to design can be further operationalized and used to sustainably support resilience.

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

Additional Key Words and Phrases: resilience; assets-based approaches; intersectionality; community health; digital payments; HCI4D; ICTD

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1 INTRODUCTION

The fields of CSCW and HCI have increasingly focused on how to engage with vulnerable and marginalized populations to understand and support the well-being of individuals and communities (e.g., [7, 23, 31, 92]). A significant body of work focuses on resilience, which across multiple domains such as health, disaster response, and more, is broadly defined as positive adaptation in light of challenging circumstances. Many studies in CSCW and HCI fall under this umbrella (e.g., [1, 2, 36, 37, 41, 47, 49, 73, 86, 89–91, 94]). Although they do not always use the term resilience, these studies examine responses to adversities such as sudden change, ongoing lack of particular material resources, or breakdown of infrastructural support. For example, Mark and Semaan have investigated new practices that arise during crises or emergencies [47, 49], while other work examines how communities respond to systemic marginalizations, through technology and through social ties, care, or solidarity [34, 38, 86, 89–91]. Another body of work specifically looks at the

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creativity and resourcefulness that arises out of scarcity, such as practices of *kanju* throughout Africa [64], *jugaad* in India [41, 73], or repair cultures across the Global North and South [1, 29, 37, 94].

Within this rich body of work, studies have focused on the actions that people take to be resilient [36, 37, 41, 47, 73], how technology design can support those actions [49, 86], and how resilience, particularly innovation, among marginalized populations should be recognized and legitimized within CSCW and HCI [1, 37, 94]. However, prior work has hinted at the cost of resilience as well. Studies of the frustrations behind necessity-driven entrepreneurship [30], the competitiveness and undervaluation of repair work [1], or the gendered nature of creative infrastructural action [36] all begin to point to how enacting resilience can have both positive and negative impacts. Literature on resilience [8, 14] calls for greater attention to the broader impacts of being resilient, as well as how “the gains and losses of adaptation, and being part of a resilient system, are distributed within society” [14]. Thus, we ask how we can support resilience in ways that more purposefully tie it to well-being and make it a more sustainable endeavor.

We contribute a study of resilience in a community health infrastructure in rural southwest Kenya. Our study began by exploring how the Ministry of Health (MoH) and non-governmental health organizations compensate community health workers through digital payment methods, backdropped by ongoing issues with payment delays and missing payments. These mandated payment methods presented a deviation from previous cash-based payments, and community health workers additionally needed to cope with missing and/or delayed incomes. To understand how multiple stakeholders responded to these issues, we interviewed staff from the MoH and health organizations, informal community health volunteers (who were paid volunteers in this context), and formal workers, such as community health assistants and nurses. We take an explicitly assets-based and intersectional approach to analyze our data. These lenses together bring attention to how differentiation among groups shapes the assets and constraints that individuals and communities mobilize in enacting resistance to systems of domination [15, 16, 92]. We analyze the different assets and constraints workers had on account of their varying backgrounds and contracted status, and how they engage with them to cope with change and adversity, allowing us to understand the distribution of the broader impacts of resilience.

We begin this paper by situating our study in theoretical and empirical work on resilience and the need to understand it through an assets-based and intersectional lens. We then describe our findings around how the community health infrastructure adapted to new digital payment methods and coped with ongoing payment issues, highlighting the actions of different stakeholders. This enables two contributions. First, we leverage these findings to offer considerations for using and organizing around assets in light of intersectional experiences. Second, we discuss how this nuanced understanding of assets can inform design towards supporting more sustainable forms of resilience.

2 RELATED WORK

We connect to and expand multiple areas of scholarship in CSCW and HCI. We first discuss definitions of resilience, motivating the use of an assets-based and intersectional approach to understanding it. We then situate resilience in the contexts of adoption and use of digital payment methods, the politics of labor in community health, and technology use in Kenya more broadly. Our study contributes to the further operationalization of assets-based approaches to design and how it can support more sustainable forms of resilience.

2.1 An Assets-based and Intersectional Approach to Understanding Resilience

Hart et al. discuss numerous definitions of resilience in research and note that there is little consensus other than that it “assumes adversity and is relative to it” [28]. We thus describe how resilience has been used in various domains and discuss critiques of how it could be theorized to

better tie it to well-being. We then discuss how taking an explicit assets-based and intersectional approach to understanding resilience aligns with these critiques.

2.1.1 Defining Resilience. Theoretical literature on resilience has primarily been in the domains of human development, ecology, policy around disaster response, and sociology. Work in human development often views resilience as an individual trait, studying how individuals achieve positive outcomes (say, psychologically or academically) in response to change or adversity, such as losing a job, experiences of domestic violence, or poverty [81]. These studies have focused on how individuals perceive themselves, process trauma, and use traits like problem-solving skills or perseverance to be resilient [60, 67]. Seminal work in ecology [87] and disaster response [50] has theorized about resilience beyond individuals, encouraging a focus on resilience of entire systems and at different scales. From a more critical perspective, work in sociology has argued that resilience as an individual trait ignores structural factors like discrimination that strongly affect individual agency in responding to change or adversity.

Because our study is focused on resilience among socioeconomically diverse stakeholders, we draw on definitions where there is a serious acknowledgement of structural factors in how members of a community can and do work towards well-being in response to change and adversity [26, 28, 65]. These definitions shift the analysis from individual traits, or even individual strengths as in prior HCI work [86], to the “navigation” or “negotiation” of resources, and the availability of resources, to work towards well-being [26, 28]. These definitions of resilience consider the roles of groups, organizations, and institutions as they are stakeholders in a community and influence structural factors. They also discourage looking at whether well-being has been “achieved” in response to change and adversity as this can ignore efforts to be resilient and presumes a single desired outcome. Instead, we are encouraged to take a process-oriented perspective to look at how efforts to be resilient play out and are distributed among diverse groups within a community [8, 14]. Finally, these definitions mean we must necessarily view resilience in context, acknowledging that there is no one way to be or become resilient.

Studies in CSCW and HCI have largely studied how technology plays a role in various forms of resilience, and they prompt further questions around how to grapple with the broader and sometimes negative impacts of being resilient. Studies of resilience to disaster, displacement, and war have described the unpredictable nature of resilience, and the ways technology might present new, positive courses of action during periods of change [2, 48, 49]. Studies also look at how vulnerable and socioeconomically marginalized populations form and maintain valuable social ties and manage resources, such as by turning to community savings groups or relying on intermediated mobile phone use [10, 12, 18, 25, 79]. Expanding on innovation as one aspect of resilience, prior work also studies repair, creative workarounds, and appropriation of technology [1, 37, 41, 77, 94, 97]. In the Kenyan context, Wyche and colleagues’ studies of repairers in rural Kenya and Facebook use for income generation point to how local knowledge and innovation should be leveraged towards appropriate technology design [94, 97]. However, prior work has also studied contexts in which resilience, while furthering well-being, has negative implications as well. For example, Jack et al. study how the resourceful creation of a sales network in Phnom Penh, Cambodia was subject to gendered notions of labor [36], while Jackson et al. and Ahmed et al. highlight the competitiveness of repair work that results in gatekeeping against new apprentices [1, 37]. We delve deeper into how to think about the negative impacts of resilience and how the navigation of resources might be supported to make resilience more sustainable.

2.1.2 Taking an Assets-based and Intersectional Approach to Resilience. In order to attend to the navigation of resources as well as structural factors that shape diverse groups’ and organizations’ actions towards resilience, we take an explicit assets-based and intersectional approach to discussing

resilience. We describe and justify our use of these approaches, as well as how our findings can contribute to the further operationalization of assets-based approaches in CSCW and HCI.

Assets-based approaches in CSCW and HCI are underpinned by assets-based community development (ABCD). ABCD is an approach to community development formulated in the context of low-income neighborhoods in the United States. It encourages first identifying or mapping assets within a community [52]. Assets have been defined broadly in the ABCD literature so as to include anything that might be “engines of community action,” ranging from individual talents, social capital, and local institutions, to voting rights and leadership capacity [51]. Community members might then organize to leverage these assets to address social problems relevant to them [52]. ABCD is centered on the notion that development is more sustainable if it is driven by and from within a community, as opposed to framing community members as dependent on others [39]. This aligns with the goals of the HCI community of creating technology interventions that are sustainable [70] and that are based on deep engagement with the context of deployment.

Assets-based approaches within CSCW and HCI (e.g., [11, 34, 38, 70, 92, 98]) have borrowed from ABCD, sometimes loosely. Karusala et al. use the vocabulary of leveraging, extending, and supporting care, an asset in their context, through technology design [38]. Cho et al. draw from the method of appreciative inquiry, or interviews that focus on the successes of participants, to identify assets, and further suggest creating user personas inspired by assets [11]. Wong-Villacres et al. suggest attending to and comparing the everyday struggles *and* resistance among different marginalized populations in order to highlight assets and constraints for technology design [92]. These works have named non-material assets, like care, solidarity, and social networks, as well as material assets like mobile phones, internet connectivity, and electricity [11, 35, 38, 70, 92]. However, as ABCD encourages both identification and use of assets, we note that there is less systematized understanding of the complexities of actually using assets, in technology design and beyond. Indeed, Mathie and Cunningham note that acting on assets is particularly complicated in communities characterized by uneven power relations among members [52], and Mathie et al. have pointed to the need to learn from the process of leveraging assets in order to better understand the possibilities and limits of ABCD [51].

In our study, we draw on the work of Wong-Villacres et al. to analyze how diverse populations navigate resources. They observe that intersecting forms of marginalization often shape what assets and constraints individuals, groups, or organizations engage with to further their well-being. Wong-Villacres et al. use the notion of intersectionality—this is a term coined by Crenshaw [15] to recognize that people often embrace multiple identities and experience multiple intersecting forms of marginalization. Crenshaw argues for example that black women experience forms of marginalization that are not fully accounted for as either gender-based or race-based, and thus that an effective politics of liberation must recognize their intersectional experiences as black women. Applying an intersectional lens to our analysis of assets and constraints highlights how the experience of resilience may vary across groups. Different groups have varying access to resources, and face varying constraints, which shape their actions and prospects for resilience. We argue, in turn, that an intersectional lens on assets and constraints can advance our understanding of the structural aspects of being resilient, highlight how experiences may differ among stakeholders in a community, and draw attention to what these differences might mean for technology design.

2.2 Resilience in the Study Context

Resilience in our context is in part how organizations and workers responded to mandated technology adoption. Looking at payment methods, a recurring theme is having to respond to the switch from cash to digital. Employers and governments are often the ones pushing for such change [22, 85], and workers and citizens on the other end of the transaction, as well as the overall design

of payment processes, are expected to keep up. CSCW and HCI have looked at cases such as the impact of demonetization in India, the removal of cash payments on London buses, and the adoption of mobile money-based loan repayments by Indian auto rickshaw drivers [66, 69, 72]. Studies find that digital payments generally benefit the organization more than payment recipients' well-being [3, 4, 9, 19]. Meanwhile, much work from both stakeholders is required for adoption, with studies looking at factors such as trust, integrating with the wider financial ecosystem that users participate in, and the points of inflexibility introduced by digital payments [40, 54, 66, 71, 72, 78]. Notably, M-Pesa, a mobile money system operated by the mobile network operator Safaricom, has received widespread adoption in Kenya, largely because of its alignment with practices that users were already exhibiting in sharing airtime [6]. About 70% of the population in Kenya has a mobile money account with M-Pesa [68], and it is used widely in underserved areas in particular [36, 58]. Prior work in HCI has found that M-Pesa payments are a part of family communication [61], and has noted the range of challenges that rural Kenyan women face in using M-Pesa and associated services [95, 96]. Adoption of bank accounts and associated mobile banking and bank agents is less widespread particularly in rural areas [20]. In this context, our study of the switch to digital payments contributes to our understanding of the scaffolding role of organizations and of how workers responded to the change.

Resilience in our context is also in response to ongoing payment delays and the resultant unpredictable income. Community-based public health organizations often rely on both salaried workers and volunteer frontline health workers. Prior work in numerous sub-Saharan countries including Kenya documents how, while frontline health workers join the role for self-development and community involvement [83], issues such as inadequate or inconsistent payments, or no compensation at all, result in decreased motivation to work [24, 46, 84]. This is worsened by the additional personal costs that health workers sometimes must incur over the course of their work [27]. Bringing attention to political aspects of the issue, Maes also finds that the "pricelessness" of frontline health workers has also been used by public health organizations as a reason to not pay them at all [45]. An overburdened healthcare sector in general also means that formal workers face difficult working conditions, low wages, and payment delays [33]. For example, Kenya has faced repeated organized strikes by formal health workers (largely nurses and doctors) since devolution of health administration to local governments, including an extended strike in 2017, the year before our study [33, 44, 62, 63]. We examine perspectives on working conditions and modes of resistance from formal and informal workers, and align with prior work in CSCW and HCI examining the oft-neglected labor of workers [17, 32, 74, 82], including in health systems [35].

3 METHODOLOGY

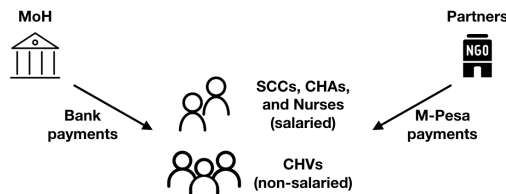
We conducted an exploratory study of digital payments within the community health infrastructure of a county in southwest Kenya, focusing on how workers are paid and the realities of missing and delayed payments. This ecosystem consisted of the county's local Ministry of Health (MoH), the health workers they employ, and non-governmental public health organizations or "partners" working in the area. We describe the field site and payment flows among actors in detail, and then explain our process of data collection and analysis.

3.1 Field Site

There are multiple types of health workers in the county; they work under and are paid by the MoH but also receive payments from partners (as shown in Figure 1) for research or training activities around healthcare provision or mobile health interventions. Community Health Volunteers (CHVs) are frontline health workers who visit homes in their villages and refer residents to hospitals when needed. CHVs are managed by field community health assistants (CHAs). There are also nurses who

work at dispensaries and hospitals. Finally, there are sub-county coordinators (SCCs) who manage the CHAs in each of the county's six sub-counties. The MoH pays all health workers through bank payments. Nationally, CHVs are indeed volunteers and non-salaried, but in the county where we conducted our study, they receive a monthly stipend of KES 3000¹. SCCs, CHAs, and nurses are salaried and paid monthly, receiving salaries from the MoH ranging from KES 60,000 to 75,000 per year. Health workers of all types sometimes work with partners. They receive smaller payments of KES 500 to 1000 for these activities, often through M-Pesa or sometimes cash, depending on the partner. However, the reality was that payments from both the MoH and partners could be delayed, as we will detail in the findings.

Fig. 1. Stakeholders in Field Site



3.2 Data Collection

Our study began as a collaboration between academic researchers with expertise in HCI and digital financial services (Naveena and Richard) and Medic Mobile, a health organization working with the county's MoH on mobile health solutions (co-founded by Isaac). We worked with local Medic Mobile staff and the MoH in setting the objective of the study and gaining approval for the study design. Naveena carried out the study over the course of two weeks in May 2018. During this time we conducted semi-structured interviews and focus groups with health workers and staff from the MoH and partner organizations. We spoke with 25 CHVs via 15 interviews and two focus groups of five participants. We also interviewed five CHAs, three nurses, and two SCCs. We also spoke with five staff members of four organizations (including the MoH) who could speak to their organization's payment processes.

We aimed for diversity among health workers in the recruitment process. Naveena worked with Medic Mobile's local field project manager in the county to recruit health workers, some of whom the project manager had worked with in the past (health workers often worked with more than one partner, so they were able to describe their experience with multiple organizations' processes). We used purposive sampling to recruit health workers of each type from diverse backgrounds. Participants lived varying distances from the county's major towns (which were also financial centers), and had a range of digital and financial literacies. Workers' ages ranged from 25 to 65, with most participants in the 30 to 50 age range. Twenty-five of 33 health workers were women; this reflects the fact that most health workers in the county are women.

We sampled widely for partners as well. Among the four we studied, three were non-governmental organizations—CARE Kenya, Medic Mobile, and Kenya Community Health (KCH). The MoH was a government entity and managed all the health workers in the county. Medic Mobile was the smallest organization, with CARE Kenya and KCH operating at a larger scale. Both Medic Mobile and CARE Kenya had switched to digital payments while KCH was using cash and intended on

¹KES refers to Kenyan shillings; at the time of the study, KES 100 = USD 1

switching to digital payments in the future. We recruited staff members of these organizations through snowball sampling, starting with Medic Mobile, as this was how we could begin engaging with more organizations operating in Kenya and directly contact individuals who would be able to speak to the organization's financial decisions.

Interviews were conducted at hospitals and dispensaries that health workers often reported to or gathered at; Medic Mobile's field project manager accompanied Naveena on each interview. In interviews and focus groups with health workers, we asked questions about how they are paid, preferences around payment, and any challenges they had in receiving payments. We sometimes received conflicting information about how processes worked—we triangulated information through multiple interviews but took conflicts as a signal of different interpretations and availability of information. For some participants, asking about payments may have been associated with criticizing or speculating about one's employer. As a result, before each interview, we ensured that participants knew this was an exploratory study to constructively learn from health workers' experiences with payments, negative or positive, and that all data and identities would be anonymized. In interviews with representatives of public health organizations, we asked about the design of their payment processes, motivation for their design choices, and experience with implementing them.

Interviews were audio recorded, unless they took place over phone, in which case we took detailed notes (as was the case with two partners' staff who could not meet in person). Interviews ranged from 30 minutes to an hour. Naveena conducted the interviews in English, which most participants had intermediate or high fluency in. In cases where participants were not fluent or comfortable with English, Medic Mobile's field project manager interpreted Swahili and English.

3.3 Data Analysis

The process of data analysis started by iterating on the interview protocol as we interviewed participants. After data collection, Naveena transcribed each interview, using English translations of interpreted interviews. We then followed inductive interpretive analysis as described by Merriam [56]. Starting with open coding of the transcripts, Naveena labeled phrases with codes, such as "traveling far to withdraw from the bank" or "calling about missing payments as a group". Over several iterations, we (based on conversations and extensive field notes) agreed upon a set of high-level codes such as "adopting bank payments" and "coping with missing payments". These codes brought out a set of themes that spoke to the resilience of workers and, in part, organizations, around which we structured our findings.

3.4 Self-Disclosure

We recognize that the collection, presentation, and discussion of the data in this paper is shaped by our identities. All data was collected by Naveena, a woman of Indian origin, whose prior research has been conducted in parts of India and the United States. While health workers were familiar with working with partners, the presence of Medic Mobile's field project manager (who lived in the county and had previously worked with some of the health workers we interviewed) during interviews may have affected how participants described their experiences with Medic Mobile, but also helped us establish rapport. Data analysis was led by Naveena in conjunction with Isaac and Richard, both white males from the United States with extensive research experience in global health in east Africa and south Asia. We also note that the differences we saw as relevant in the data, such as the difference between formal and informal workers, became salient because of the set of questions we chose to ask and the topic we explored with participants.

4 FINDINGS

We present our findings on how a community health infrastructure displayed resilience amongst workplace changes and challenges. We describe responses to mandated technology adoption, how workers coped with lack of income, and how they attempted to follow up with organizations to recover delayed or missing payments, also mentioning organizational actions where relevant. In examining these enactments of resilience, we pay attention to how workers considered both assets and constraints to achieve personal goals despite change and unpredictability. Throughout, we highlight how efforts to be resilient were shaped by various intersecting factors such as digital and financial literacies, remoteness from the town center due to urbanization, socioeconomic background, contracted status, and amount of pay as determined by the MoH.

4.1 Adopting and Adapting to Digital Payments

In looking at adoption of digital payments, we focused on the MoH's introduction of bank payments to CHVs in 2010, and partners' introduction of M-Pesa payments to all health workers in the early 2010s. We found that introduction of bank payments required scaffolding and collaboration, while M-Pesa payments were integrated more easily, though they still presented a deviation from cash. We also found that over time, adaptation for CHVs in particular manifested as lower engagement with banks as compared to M-Pesa, and as the use of digital payments despite ongoing confusions.

4.1.1 Setting Up Bank and M-Pesa Payments. In 2010, Kenya's national government began a multi-year process of devolving health administration to county-level governments, so the county MoH became charged with paying its staff with funding from the national government. At the same time, the county's leadership decided that CHVs would start receiving a stipend as a *"token of appreciation"* (CHV8), notably becoming the first county to pay its CHVs. Salaried staff (CHAs, nurses, and SCCs) had already been receiving bank payments previously. Setting up bank payments involved having all CHVs create bank accounts, a year-long process in which workers *"really faced a lot of challenges"* (S1, MoH), due to different constraints arising out of CHVs' varying degrees of financial literacy and remoteness from the town center. Uptake of banking among some CHVs, particularly in urban areas, was already high, but adoption was slower and more difficult for CHVs from more remote areas. Many CHVs had to apply for a national identification card for the first time (at the time of bank payments being initiated), obtain identification photos, and pay the additional cost of transportation over long distances to town centers to submit materials and open an account in person. At the same time, the MoH and workers who managed CHVs were able to scaffold the process, acting as assets for CHVs in the interest of setting up payment processes. For example, once CHVs opened accounts, they also had to submit their account information to the MoH to get paid. Among CHVs who were less familiar with banks and their workflows, many submitted incorrect account numbers, or ATM card numbers instead of account numbers, which resulted in complaints of missing payments. In response, the MoH liaised with banks to gather correct information, asking CHVs to go to their bank and specifically request their account number, while CHAs and SCCs were charged with sensitizing CHVs to different types of numbers.

Despite the effort and missing payments this process involved, there were some immediate perceived benefits to opening a bank account (beyond the prospect of receiving a stipend). While many CHVs perceived banking to be *"too complicated"* (CHV6), some CHVs, particularly those who lived near the town center, remembered the opening of bank accounts as an introduction to an asset that they could choose to leverage. CHV2 described how *"when we were told that we would be paid through the bank, each one of us had to go and open an account. That means it gave others opportunity at least to go there, open accounts, and know what it is to use our banks."* From there, CHVs saw opportunities to learn new financial practices and procedures, as CHV5 shared: *"Some*

of us had never even entered in the banks. The procedure of withdrawal, maybe they didn't know, so they're given the opportunity to save for themselves." However, this did not necessarily hold over time, as we discuss below.

The partners we interviewed, along with the majority of partners operating in the county, had generally switched from cash to M-Pesa in the early 2010s to pay health workers travel stipends for participation in research or training activities. Organizations we talked to were motivated to switch to mobile money as they scaled up in operation. For both organizations and health workers, this was a much simpler and less disruptive process compared to setting up bank accounts. True to accounts of the widespread popularity of M-Pesa use throughout Kenya [68], most health workers had already used M-Pesa in the past to, say, receive or send money to family, as found in [61]. Additionally, M-Pesa was designed in a flexible manner that supported adoption. As staff from CARE Kenya described, *"the transaction doesn't require a smartphone. You can do it on any feature phone and also maybe if you don't have yourself, then your trusted beneficiary—if a CHV is a lady and she doesn't have a phone, she uses the one from her husband, and vice versa"* (S2). Thus, M-Pesa as a mandated method of payment aligned with existing and diverse assets around technology access.

We also noted power dynamics in the way health workers, particularly CHVs, perceived the need to be resilient and adapt to new payment methods. Health workers often paid for daily purchases such as food and clothing in cash, as that was the main form of currency in surrounding areas. CHVs who ran side businesses such as selling vegetables or sugar were also paid in cash for these goods. Ultimately, cash was the currency that could actually be used in health workers' daily lives. As a result, health workers needed convincing that using M-Pesa was a good idea in general and that uptake of digital payments would be smoother:

"They [health workers] are open to getting M-Pesa, but the problem is people will always prefer cash. But you know, you as the activity organizer, have to tell them the benefits of why you're doing that [...] Then they know very well that is the mode of payment that they will get." (S2, CARE Kenya)

This did not mean that workers were entirely convinced that M-Pesa was best for receiving payments, as much as they understood that they did not have a say in how partners paid them. CHV12 shared his perception that *"they have their own ways of working operation. So you can't get in and start telling them that you should do this and this and this. If you do that, they can even say no, we are not dealing with you people, we are going on another site."* In fact, CHVs from remote areas mentioned how useful it would be to get paid in cash during trainings with partners. CHA2 explained that *"maybe a CHV has come from far, she or he has used transport, and then maybe she borrowed that money from someone else, so it's good if you just pay them cash instead of M-Pesa."* Here, we can see how resilience through adaptation, while certainly being a conscious choice, is also laden with what workers perceive to be the relative costs of not adapting or of demanding changes—in this case, the income that comes from working with partners.

4.1.2 Sustaining Digital Payment Use in a Cash Economy. As digital payments became the official method of compensation, health workers needed to adapt these methods to their daily lives. How health workers felt about each payment method was related to the assets and constraints associated with their place of residence and status as informal or formal workers, combined with how well the features of digital payments aligned with their priorities.

Most evidently, receiving bank payments was much more disadvantageous for CHVs simply because their work status meant that they were paid much less than salaried health workers. As CHV17 shared, *"It [bank payments] is not ok, because the stipend is so little, then it goes to the bank account, the bank account also slash it and then it becomes less. I'm supposed to get 3000 and I'm getting 2500."* Though CHVs accepted that this was the process for getting paid, many CHVs wished

they were paid through M-Pesa instead. Indeed, CHVs preferred M-Pesa payments because they had much lower transaction fees (KES 27), which some partners covered by paying workers that amount in addition to the regular payment. Here, we see organizations taking on constraints for workers, in part because M-Pesa levies relatively manageable fees and also in part because the organizations chose to prioritize working conditions in addition to their primary missions of improving health care delivery.

Considering the dominance of cash in health workers' lives, health workers also needed to adapt to the process of converting digital forms of money, once received, into cash. The ease with which workers could adapt was shaped by their income and place of residence. With respect to banks, they were relatively accessible for salaried workers but only a minority of CHVs. Similar to how this caused issues for opening bank accounts, this was due to the fact that most salaried workers lived near the town centers where banks and ATMs were located, while many (though not all) CHVs lived in more remote areas. For these CHVs, traveling to the town center had significant costs, essentially taking money out of their stipend on account of their place of residence:

“With a bank account, it’s complicated because you have to travel all the way to town. For instance, I have to use 300 shillings to and from and you deduct the bank transaction fee, that’s around 300 again. I’ll have lost 600 to go and withdraw 1000 or maybe 2000.”
(CHV7)

There were workarounds in place for making banks more accessible, though still costly, such as withdrawing from local bank agents (for a fee). The MoH once again attempted to scaffold, directing CHAs and SCCs to encourage CHVs to download mobile banking apps to transfer money from the bank to M-Pesa, which was easier and cheaper to withdraw from. However, uptake was low among CHVs with lower digital literacies and as CHA5 commented, *“the fees add on from the bank payment to mobile banking, from mobile banking to M-Pesa, from M-Pesa to cash,”* demonstrating the difficulties that arise out of the way financial systems aim to keep money strictly digital and within the system [55].

In the end, CHVs chose to go to the bank very selectively. Some CHVs had SMS alerts from their bank to see if they had even received money to withdraw, in light of how payment delays resulted in unpredictable payment deposits anyway. Many CHVs did not register for SMS alerts as they perceived them as costly and had to register their phone with the bank—instead they relied on meeting their social network of fellow CHVs at work-related gatherings or savings group circles to gain more information: *“one of you goes to the bank and finds out whether the money is there, or somebody else has an alert, that is when you know when money is there. Otherwise, the money can be there, and if you don’t visit your bank regularly, you might not know”* (CHV2). At the same time, to some CHVs, their distance from banks was actually an asset that made banks inaccessible and therefore useful for long-term saving. As CHV19, mentioned, *“It’s safe there, I’ll not be tempted to use, because I have to go to [the town center] [to withdraw]”*, a perspective driven by the desire and option to save.

Many health workers saw M-Pesa as a more accessible form of payment. Especially for CHVs in remote areas, they could walk to an M-Pesa agent and *“just incur transaction fees and not transport fees”* (CHV7). Even CHVs who had used trusted beneficiaries to receive money felt they could reliably access money through them. Many CHVs mentioned using M-Pesa to save money, as has been found in prior work [36, 58]. M-Pesa also aligned with CHVs' other financial needs such as being able to pay school fees, make loan payments, and take loans through M-Shwari, aligning with prior work that studies M-Pesa in the context of family life [61]. Many CHVs did not receive bank services or perceive the same utility in banks. As CHV12 described, *“We are not confirmed as county workers. It’s like we are the casual laborers, and casual laborers can’t get loans from the bank.”*

This, combined with the factors described above, led to the general lack of engagement with bank accounts even after access, as noted in prior work [57].

Meanwhile, salaried workers were better served by banks not just because they were physically accessible, but because they were attached to other assets that they could leverage. Salaried workers had the added benefit of being approved for other bank services, such as loans and auto-deduction of loan payments from salaries. Meanwhile, the high accessibility of M-Pesa was actually seen as a negative factor—it made it a more immediate, tempting form of money. As SCC1 said, “*if it is in M-Pesa, I’ll use all of it.*” Similarly, one CHA even avoided mobile banking because “*once you know you have this amount in your bank, you’ll be tempted to go for it anytime*” (CHA3). Salaried workers also felt that large sums of money such as their pay should go into a bank account rather than M-Pesa for long-term saving and perceptions of greater security. Thus, we can see how different payment methods cost more or less to adapt to, leading to different perceived levels of utility among workers depending on their financial priorities.

4.1.3 Continuing with Unresolved Concerns. Despite bank and M-Pesa payments having been established for several years at the time of the study, we found that there were many ongoing points of misinformation and concerns still circulating regarding digital payments, pointing to how workers with diverse literacies had adapted to these new methods without needing to or even wanting to resolve their concerns as long as they could receive a salary.

In many interviews, there was confusion around the exact fees levied on bank transactions, even though they were standard within a bank. In one interview, we learned that CHV18 and her fellow CHVs were not aware that in addition to fees for withdrawing from bank agents (KES 110), banks also levied transaction fees (KES 300-500) when salaries were disbursed, and so she was suspicious as to why their stipends had an amount greater than KES 110 deducted from them:

“We were told the banks were supposed to deduct only 110 per month. We are told our stipend is 3000 per month. As from, February, March, April, is three months now. But you will get, we will be given only 7500, or 7600, who are these 2400 going to? Hm? If the bank is only deducting 110? [...] We don’t know what is going on there.”

While the Medic Mobile staff informed her that banks charge more in addition to the agent withdrawal fees, this scenario indicated the limited avenues for CHVs to act on their concerns around using new payment methods, and more notably, the willingness to continue using them regardless. While CHV18 and her coworkers were suspicious, banks payments were the only way to receive income, and resolving her suspicions would likely require labor in terms of information-seeking.

Over time, the opacity of bank accounts combined with delayed payments also resulted in CHVs being unable to tell which month a bank payment was for. In fact, many CHVs simply stopped caring since payments would just continue to arrive months apart due to payment delays. As CHV3 laughingly noted, “*they can put [pay] one month and relax. Then another until you get confused which ones are missing and which ones are paid.*” Combined with the misinformation about fees, this indicated that information about payments was not easily discoverable, attesting to the opacity of digital payments [54, 78], especially compared to human interactions involved in cash payments.

With respect to M-Pesa payments, health workers noted that errors in payments could still be made every once in a while. When health workers attended activities, partners would collect health workers’ names and mobile phone numbers to record attendance and send payments. According to both workers and partners, workers sometimes wrote illegibly or wrote down a number that was not registered with M-Pesa or Safaricom. This was more common among those with less familiarity with the inner workings of M-Pesa. Sometimes workers would not remember to sign the sheet, or they would write the number of a trusted beneficiary without realizing that meant that the

money would be sent to that person's phone. To avoid these issues, partners' project managers and CHAs needed to sensitize health workers, particularly CHVs, on remembering to fill out the sheet, writing legibly, using a registered number, and understanding conceptually that the number written on the sheet is where the money would go. Partners had a hand in creating more or less resilient processes as well. Workers mentioned that some partners were slow to make the payments, sometimes because they might not have had funds readily available. However, Medic Mobile (and other partners that health workers reported interacting with) paid health workers immediately after signatures were collected, by budgeting money ahead of time and requiring that project managers process forms quickly. Immediate processing had added advantages—if the project manager noticed legibility issues or that some transactions did not go through, they could inform the health worker while they were still present for the activity.

4.2 Keeping on while Payments are Delayed

At the time of our study, CHVs had not been paid by the MoH for five months, and salaried workers for two months because funds were delayed from the national government, as the MoH and health workers told us. When payments did arrive, it could be the accumulation of delayed payments or just one month's worth. We describe the various ways that health workers coped with unpredictable income in their work and financial lives, acting on the assets and constraints at their disposal.

4.2.1 Managing Work with Payment Delays. Salaried workers and CHVs generally reported that they continued to work despite payment delays, to ensure that the community health infrastructure in the county as a whole remained resilient. Much of this resilience stemmed from the fact that health workers cared deeply about their work and their community, and that it brought them a deep sense of satisfaction. CHA1 described how he and N1 were driven by *“the passion for whatever work you are doing. Like, she's a nurse, she has that passion, that passion to prevent diseases.”* CHVs in particular felt that their work made them useful, respected, and trustworthy to their community, with CHV2 likening themselves to teachers and supporters:

“Actually the reason as to why we love this job despite the payment and the late stipend, is that we have the burden of our community. One thing that we like is that you didn't know how to take care of this child, we come there, we show you, we talk with you, we see the changes, you start being responsible, you start taking care, that is what makes us happy in our life. [...] we want to save the whole community, because we are carrying the community.”

At the same time, workers needed to constantly temper their expectations around payment, which was laborious in and of itself especially *because* work was a mainstay in participants' lives. N1 described how *“if you come to work for 60 days, and you've not seen anything, that's where you spend most of your time. Yeah... We feel demotivated.”* Additionally, continuing work for the satisfaction did not make it easy, and could actually be an additional constraint on top of payment delays. The physical work of traveling to and conversing with households and attending partners' activities required time and energy that was scarce due to the cascading effects of payment delays, as CHV18 described:

“We are affected because you can only go if your household, if you are in a good mood. Sometimes you don't have anything to eat as lunch, children are lacking school fees. Even your farm, you can't even achieve good products because you don't apply any fertilizers. It is hard to visit households when you're not comfortable.”

Indeed, participants often used such language to differentiate being well “in” the home versus “out” visiting households, explaining how *“you have to be fit at home to work”* (CHV13). Strong

motivations existed to work, but also to, say, ensure children were properly cared for, which meant consciously prioritizing different forms of well-being in the process of adaptation.

The unpredictable financial costs that arose in their work also compounded payment delays, and workers did not seem to feel like they had a choice in avoiding such costs due to their moral and professional values. For example, CHA3 mentioned that some CHAs were given motorbikes to ensure they could travel to remote areas. Occasions arose “... *when it is not in order and I want to service it, so it becomes a challenge especially if there is no salary.*” In another example, the community visibility CHVs had and desired in their role could become a constraint, as CHVs were often approached by patients in emergencies, resulting in costs that CHVs felt obligated to pay:

“Two years ago, a woman comes to me at 2 or 3 [in the morning]... I rushed her to the hospital but she didn’t have anything. So if I didn’t have something, I would not have saved her life. We rushed her to the hospital, when reaching there, a woman doesn’t even have money for clothes for the baby because she comes from a poor family. And her husband is a drunkard. So it is me who used my money to help the newborn baby.” (CHV15)

4.2.2 Changing Financial Practices during Payment Delays. What was particularly difficult about payment delays was not just lack of income, but the unpredictability of income. Due to both these factors, health workers turned to various resources at their disposal to maintain financial stability.

As CHVs were given a relatively small stipend that they needed to temper expectations around even receiving, they needed to have alternative ways of making money. As CHV2 said “*so you have to think, think and be creative and say yes this is just an addition. We appreciate, but think, otherwise our children could not go to school if it is only this job that we are looking after.*” As a result, unlike salaried workers, many CHVs were also maintaining jobs, or what many CHVs called “side businesses”, such as catering, selling cereals, sugar, and clothing, or maintaining small farms to sell vegetables. However, many CHVs said there were days when they intended to work on their side businesses to make enough money but instead, as mentioned above, had to attend to unexpected, pressing responsibilities such as transporting a patient in need to the hospital. CHVs reported that disruptions could come from work as well. As CHV8 explained, “*maybe you had planned tomorrow to go and do something on the farm and then you’re called at night, you’re told tomorrow we’re meeting at the facility, make sure you come on time.*”

Another asset that health workers turned to was loans, which meant taking on constraints to be handled in the future. Health workers were resourceful in finding loans, turning to friends and family, shops and shopkeepers, M-Shwari, savings circles, and banks, with CHVs rarely taking loans through banks. Loans could be an asset in that they could entirely resolve some pressing expenses in the short term, for example covering school fees so that children are not at home during the day. However, unpredictability meant that some health workers struggled to keep promises about when money might be paid back, which could have further consequences. SCC1 described how “*You’re telling the landlord that you’ll give money by the end of the month. When the month ends you don’t have that salary. So some will say that you’re joking with them, you have to vacate their houses and leave for other people to rent.*” CHV1 also explained the additional labor that arose out of unpredictability, saying how “*this one of the county government, I’ll cheat you, I’ll dodge you, because that money’s not there. I’ll probably see you but that money’s not there.*” Meanwhile, participants who could borrow from banks had the benefit of being automatically granted a grace period, as SCC2 described. Once payments did arrive, the loans and monetary needs accrued over time meant that the stipend was spent immediately. N1 described how “*when it comes, maybe you have some debts you have to pay, maybe you have a loan you have to pay. You know that insurance covers, you have to pay. So you may not get enough money to save, even for your future, your future use.*”

4.3 Demanding Payments, Delayed and Missing

Health workers also attempted to be resilient through their persistence in ensuring they received payments, both in terms of delays from the MoH or individual missing payments from banks or partners. We detail how the MoH differentiated workers, and how differences in formality then affected different workers' assets and constraints in attempting to get paid. We also look at how follow-ups for individual payments took place over time, and how past experience affected workers' future desire to conduct follow-ups.

4.3.1 Differentiating Workers and Managing Expectations. The MoH heavily influenced the assets and constraints that each type of worker had by setting expectations and defining the formality of different workers. Salaried workers had a contract and unions, and therefore had more legitimacy in demanding payments and asking for raises. Meanwhile, the MoH had control over how exactly the label of "volunteer" applied to CHVs. CHA2 mentioned that CHVs *"used to be CHWs [community health workers], but it changed to CHVs because you know when you call them workers and you don't pay them salaries, it's not that ok."* (SCC1). This sentiment was followed and reinforced by both CHVs and the salaried workers we interviewed. As N2 mentioned regarding CHVs, *"they're appreciated for the well work done. You have to be specific. It's not a salary."* Once health administration was devolved to the county level, the stipend that the county decided to give CHVs was framed as a form of appreciation—CHV2 described how a raise in the CHVs' stipend in 2016 was yet another token offered at the will of the county governor:

"When Bill Gates heard that the governor is supporting community health volunteers, [the governor] was called to have a meeting with this man. When he came back, he said ok, I went there because of you people. Let me add something small."

Despite this management, expectations of payment arose naturally because stipends became a potential asset in their lives. CHV9 said that despite being volunteers, the payment delays still mattered to them: *"Back when we were doing it without payment, we were doing it wholeheartedly, without expecting anything. Now the county is giving us something, so we're looking forward to that small amount."* In addition to wanting payments on time, mirroring prior work [46], many CHVs told us that the payments should be higher, feeling that *"they [the MoH] don't recognize us"* (CHV12). CHV1 said *"You know today, in Kenya here, even house girls [live in maids] are not paid 2500. They are paid 7000, house girls."* CHV5 in the same focus group agreed enthusiastically: *"Which means house girls are getting better salaries than a CHV. We are doing more important work than a house girl."* This is not to say that CHVs or any worker for that matter did not find meaning in their work. Rather, they aspired to improved working conditions as well, regardless of whether they had the formal authority to expect it.

4.3.2 Avenues for Demanding Payments. While making do without a consistent income was possible and workers continued to support community health, there was still a persistent desire to ensure workers were compensated appropriately. Health workers' avenues for demanding payment were shaped by the formality of their role, with salaried workers having the ability to demand payment or organize strikes while CHVs did not.

Nurses had the strongest unions, which were nationally recognized. Their strikes were organized by their union and the year before our study, nurses in Kenya had conducted a nationwide strike that lasted seven months. CHAs and SCCs also had unions, but they were at the level of the county. SCC1 mentioned how she had a WhatsApp group where members could message about concerns they had, such as not receiving promotions or going yet another month without receiving their salary. SCC1 herself would post concerns sometimes when payments were delayed. The role of a CHA was relatively recently instituted to help manage CHVs and provide health education at the

community level. According to CHA2, CHAs did not have an official union, but “*it’s just kind of a welfare thing. We meet the CHAs from [the county], we maybe share our grievances.*” They also had the ability to speak directly with staff in the MoH to inquire about payments, and CHAs mentioned that they did so. CHVs, as informal workers, did not have unions and many said that the only person they could voice concerns to was their CHA, whom they relied on to relay information from the MoH. Otherwise, “*a volunteer has no voice. We’re just outside*” (CHV12).

Despite these differentials in forms of resistance, all workers felt that their concerns were not given the appropriate attention. CHAs mentioned how the MoH, regardless of how many times workers asked, always informed workers that funds were delayed from the national government, and CHVs explained how the MoH “*always just encourages us to keep on waiting*” (CHV13). Many workers believed this reasoning from the MoH, but even among those who had suspicions that it was not true, they felt there was no choice but to accept the explanation. Even nurses, who had strong representation and in the past had sometimes succeeded in getting pay raises, felt that their long strikes were not immediately effective and could not ensure that any progress was achieved. N1 described how, at the time of our study, seven months after their strike ended, nurses’ salaries had not been increased:

“Whatever they promised, actually, they’ve not even given us. An allowance was supposed to be adjusted, but so far, they’ve not done. [...] We’re still waiting, we don’t know whether they’ll really do that adjustment. It was just signed, a collective bargaining agreement but, to the salaries, nothing has been done.”

4.3.3 Solidarity Among Workers. These differing levels of bargaining power meant that formal workers exhibited solidarity with CHVs, but it also meant that CHVs were left to deal with the shocks to the community health infrastructure that resulted from strikes.

Salaried workers displayed solidarity with CHVs in spirit and through action. Salaried workers recognized the importance and volume of the work that CHVs did and for very little pay, often voicing during interviews that they should be paid more. CHA1 sympathized with the irregular and small stipends CHVs received despite the value of their work: “*They are doing very crucial work on the community level and they have families, they have dependents, and they do quite a lot at village level. [...] And they are given 2000 every month which is just a bit. Although other counties are not paying their volunteers, ours are paid. And we are saying still 2000 is little.*” Salaried workers made efforts to understand CHVs’ perspectives over the course of their work, making sure to be understanding (to an extent) if CHVs could not come to monthly meetings or if they were sick and could not visit houses. SCC2 described how SCCs and CHAs took care to keep from “*tasking them*” (SCC2), or insisting that they do work when payments were greatly delayed.

At the same time, health workers needed to do what they could in order to improve their working conditions. When nurses went on strike for this purpose, it had mixed effects on different workers. For instance, if nurses’ strikes received productive responses from the government, that could be helpful to SCCs and CHAs in getting raises:

You know with them, they have stronger unions, the nurses. So when they talk through those unions, at least there are some, for example, they need some allowances like health service allowance, when they receive that health service allowance, it cuts across, it’s given to all the employees in the ministry of health. So it has advantages and disadvantages as well.

However, CHVs, despite being volunteers, took on the greatest amount of work due to strikes. Without nurses, the community health system became paralyzed (as was the intention, in order to demonstrate the value of nurses’ work) and patients could not go to hospitals. This meant that

community residents turned to CHVs for healthcare needs. CHVs then did their best to handle an increased workload and administered what medicines and medical advice they could without referring residents to healthcare facilities. As CHV7 described, CHVs could only do so much in terms of formal healthcare but were inundated with requests for support anyway:

We have to do a lot more because... some things are beyond us, like we cannot do ANC [antenatal care] for women. So we only treat malaria for under five [years old], even for over five [even though policy is that they only treat children under five for malaria]. So if someone needs services other than treatment for malaria, it becomes so hard for us. And the villagers, because they know we are CHVs, they'll come to us.

Not surprisingly, when asked if they felt the strikes were beneficial, CHVs explained that “it increases our jobs” (CHV7) and that “they’re not important” (CHV9). CHAs who still worked during strikes also took on some of this burden as well. When scenarios arose where CHVs could not respond appropriately, they relied on CHAs for guidance. As CHA2 described, “we do suffer, the community, because you know, every issue you’re being brought for, in case of delivery, we just go to the CHV. Now this person wants to deliver, the CHV calls me. So now we have to advise them to go to private hospitals...”

4.3.4 Following Up and Resilience Over Time. Participants also reported occasional missing payments from the bank and M-Pesa payments from partners, different from delayed payments in that these were individual incidents. According to both organizations and workers, payments went missing due to errors in the banks’ maintenance of payrolls or the contingencies of signing and sending money through M-Pesa. We found that workers’ avenues for and desire to follow up about missing payments were tied to digital literacies and the perception of whether follow-ups were likely to be effective over time.

Salaried workers and some CHVs had detailed knowledge of how to get their bank statement, how to access M-Pesa transaction history, and that no matter what one does with the records on their phone, Safaricom maintains their own records, “so you cannot cheat” (CHV13). These workers were quite confident about how to follow up with payments. Other CHVs were not sure of how to look up M-Pesa transaction history and shared that they would not know what to do if they noticed any missing bank or mobile money payments. Among health workers who had done follow-ups, they had mixed experiences that affected their willingness to follow up again and again over time. Mirroring many CHVs’ experience with fruitless bank and M-Pesa follow-ups, CHV5 mentioned the complexity of following up: “At times you go, you don’t even find the accountant, at times the accountant is there. She tells you please go back to your CHA, you go to the CHA, sometimes the CHA tells you to go to the account office.” Other CHVs said they had given up on follow-ups before because the MoH required them to travel to check records at the bank, which could be too far to travel. Some CHVs also recounted stories of follow-ups where they contacted staff at partner organizations on behalf of multiple other CHVs who had not been paid at an activity, leveraging the community of CHVs for more collective methods of following up.

5 DISCUSSION

We found that health workers were passionate about their work and cared for the health of their community. This dynamic was an asset that enabled the community health infrastructure to function despite inconsistent compensation and changes in the work environment such as new payment methods. Another asset was the scaffolding organized and offered by the MoH and partners, which in many instances, made health workers’ adaptation to changing payment methods easier. However, understanding the broader challenges in enacting resilience among different groups of workers highlights the costs of adaptation and its uneven distribution among different populations. Below,

we describe the lessons that our findings reveal about leveraging assets in complex contexts and how assets-based approaches to design might use these lessons towards sustainable forms of resilience.

5.1 The Complexities of “Assets” in Assets-based Approaches

A common facet of assets-based approaches to CSCW and HCI so far has been identifying assets in the community being studied and then acting upon them in technology design (e.g., [11, 92, 98]). Numerous works so far have shown how care, solidarity, or mundane technology are assets and can inspire and be supported through the design of interventions [11, 34, 38, 70]. This work aligns with ABCD’s central tenet of mapping assets in a community, not simply as a means to an end but in order to then organize around them [51, 52]. However, as CSCW and HCI increasingly engage with diverse communities and a wider range of stakeholders [80, 92], acting on assets as designers requires not just their identification but also explicit efforts to understand their availability to different community members and the potential (and especially negative) effects of leveraging them. Prioritizing this understanding also aligns with social justice-oriented design, which takes seriously the broadest potential effects of design and how it benefits or burdens diverse populations [7, 13]. Grappling with this unpredictability and complexity serves as further reason for the CSCW and HCI communities to continue to conduct research with an openness to findings outside the scope of study, to emphasize the intersectional experiences of diverse populations, and to engage with an ecology of stakeholders, even when focusing on specific groups. Using our findings from a study aligned with these principles, we offer questions for evaluating assets in assets-based approaches to technology design.

We found that an asset might be difficult to use or rely on in the long term. In responding to payment delays, health workers turned to loans, an asset available to them through local institutions like banks and savings circles. In many contexts, loans, particularly those provided through community [53], can be a way to make important purchases in light of relatively insufficient funds. However, the very concept of loans relies on creating debt for the future, and attending to their use in the specific context of payment delays changed the nature of having loans—because of inconsistent income, paying back loans became unpredictable, creating the labor of dodging moneylenders. To provide another example, on the level of sustaining the community health infrastructure as a whole, health workers’ care for their community was greatly relied upon as an asset. This was explicitly so with CHVs, who were differentiated as volunteers, but care was also relied upon more implicitly in the way work-related costs were not compensated or how payment delays continue unresolved across workers. The danger of relying so much on care, a resource that is finite considering the amount of labor it requires, becomes apparent through the strikes and the way CHVs uneasily described the obligation they felt to put volunteer duties first even if it cost them time and money. Through this example, we see how these limits should become a consideration for technology design that seeks to leverage and support care as an asset, as prior work has conceptualized [38]. Thus we might ask when considering an asset in the design of interventions: what are the limits of an asset and what constraints might they be tied to?

Because differentiations among populations afford different but interleaved sets of penalties and privileges, we also found that the mobilization of an asset among one group can have impacts beyond those seeking to leverage it. We saw this most clearly in how the strikes conducted by nurses, in order to achieve better working conditions, created more work for CHVs and affected the solidarity among workers. At the same time, nurses were attempting to improve their own working conditions as workers with the right to be paid, and strikes only created difficulties for CHVs because CHVs’ labor was understood as a potential asset regardless of working conditions. This characteristic of assets might also play out in more subtle and distributed ways. For example, numerous works have described how women’s mobility is intersectional, dependent on numerous factors including class,

race, and environment (e.g., [5, 21, 59, 76, 88]). Looking at how this affects assets in design, we see examples from prior work in HCI—Kumar and Anderson found that leveraging a sense of social togetherness among mothers’ groups fostered discussion and inquisitiveness around maternal health education videos, but also meant that daughters-in-law from more conservative households could not attend the groups [42, 43]. This characteristic of assets brings up the question of what the broadest impacts of leveraging an assets are, as well as what the scope of community development is—does an asset in one group, such as a strong social network, count as one in another?

We found that assets are not distributed equally among and within groups in a community, and indeed also point to the notion of “ownership” that arises when identifying assets that are unique to groups at a particular intersection, such as talents, wealth, or peoplepower. For example, the MoH and partners, as institutions privileged with expertise and peoplepower, had CHAs or field managers and know-how around financial institutions, which they used to support CHVs in switching to digital payments. The MoH and partners also had the motivation to do this in the first place—they wanted to support their workers, and it was also in their self-interest as employers as well. At the same time, it is not clear if CHVs knew to leverage this asset further, as some maintained uncertainties about the use of digital payments and how to follow up with missing payments. Another example is the MoH’s ability to determine workers’ terms of employment. The MoH chose to use their budget towards recognizing CHVs for their work, but did not need to make further promises as CHVs were still volunteers. However, on an institutional level, their ability to provide a monthly stipend in the first place was constrained by their reliance on the national government for funding, complicating the use of their financial assets. This highlights questions that we might ask of assets—how are they distributed and is there motivation or mechanism to extend them to others?

5.2 Engaging with Assets for Sustainable Resilience

Going back to the question of how to sustainably support resilience, or the navigation of resources to adapt to change and adversity, we can see that it has much to do with understanding the situated and embedded nature of assets. Not all assets are equal or distributed equally to all groups within a community. Additionally, leveraging the assets seen as available to a group might be negatively impacting well-being in other ways. This is not to say that some assets are not “good” or “helpful” enough. As prior work in HCI has noted, resilience is characterized by emergence, fluidity, and precariousness in times of change [2, 36, 37, 47], and these notions should be attended to in leveraging assets. In community health specifically, which can be shaken by disease outbreaks, varied availability of financial and human resources, and unstable presence of health organizations [75, 93, 99], the use of assets for and by health workers has implications for adaptation in community health. Our discussion emphasizes two ways in which system designers might engage with assets, in order to be more cognizant of people’s well being and prospects for sustainable resilience.

First, we would encourage system designers to investigate the assets that health workers rely on, and explore whether more generative assets, or assets that have more positive impacts, might be made available first. In our case, health workers turned to loans because they were a quick way to obtain necessary funds, but these debts had long term consequences. In cases where health systems are paying stipends or salaries to health workers, they would do well to consider how extensively health workers rely on loans and other income generating activities. This is particularly true when health systems are considering what might constitute a “living wage” in a particular locale, and how salary changes might influence community health workers’ availability for work-related activities. Where stipend or wage increases are not possible, there might be ways to establish structures that support health workers in being able to focus on their income-generating work, creating more stability where possible. This could mean the MoH and partner organizations taking initiative to be

aware of CHVs' schedules and schedule activities or meetings with greater predictability, changing the amount of disruption CHVs must face. This would require further understanding of how health workers' work is structured and communicated. Another consideration might be looking at how to support the replenishment or sustainability of assets that are often overdrawn upon in periods of change, in this case, supporting the care work that health workers, including CHVs, do. There could be utilitarian ways of accomplishing this, such as compensating workers for work-related expenses, but it could also mean understanding the feelings of obligation that health workers have and providing more of an ethical framework to navigate emergency situations or escalate them to formal health workers, especially considering CHVs' volunteer status. It could also involve probing deeper into the relationship between CHVs and higher-ups. Salaried workers reported not wanting to "task" CHVs during payment delays, and there may be other ways burnout among CHVs could be avoided.

Another consideration would be how to share assets or support the motivation to share assets such that community members are able to leverage them when needed throughout periods of change or disruption. For example, scaffolding to the point of ensuring CHVs could use digital payments ensured one equilibrium, but that equilibrium did not equate to CHVs having thorough control of the financial tools they had at their disposal, as evidenced by continued confusion about aspects of digital payments and follow-ups. We can also see that the time frame of adaptation is an important factor in the availability of assets. For example, some partners ensured that their expertise on M-Pesa payments was available when most needed—during the activities where health workers were around to clarify any issues with their signing of the form. Similarly, extending access to and awareness of assets like workplace financial literacy initiatives or streamlined methods of following up with missing payments could ensure better long-term adaptation to digital payments.

6 CONCLUSIONS

We presented a study of resilience within a community health infrastructure in a rural county in southwest Kenya, where health organizations pay community health workers' salaries via digital payments, backdropped by ongoing issues with missing and delayed payments. We examined how community health workers of diverse backgrounds and contracted status respond to the mandated use of digital payment methods and long payment delays. Contrary to the popular narrative that digital channels streamline financial management for everyone, our study revealed a mix of benefits for organizations, implementation complexities, and challenges for some workers. We demonstrated how resilience in this context is situated in workers' intersecting socioeconomic and professional identities, focusing on their uses of assets and constraints that emerged during periods of change or adversity. We leveraged our findings to discuss how intersectional, assets-based approaches to design might examine people's intersectional experiences, consider the limits of an asset or the broadest impacts of leveraging it, and thereby more carefully engage assets in adapting to change and adversity.

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