Trust, Reciprocity, and the Role of Timebanks as Intermediaries: Design Implications for Addressing Healthcare Transportation Barriers

Tawanna R. Dillahunt
School of Information, University of Michigan
Ann Arbor, USA
tdillahu@umich.edu

Juan F. Maestre
School of Informatics, Indiana University
Bloomington, USA
jmaestre@indiana.edu

Vaishnav Kameswaran
School of Information, University of Michigan
Ann Arbor, USA
vaikam@umich.edu

Erica Poon
Stamps School of Art & Design, University of Michigan
Ann Arbor, USA
ewpoon@umich.edu

John Osorio Torres
School of Informatics, Indiana University
Bloomington, USA
joosorio@iu.edu

Mia Gallardo
Department of Informatics, Indiana University
Bloomington, USA
miadgall@iu.edu

Samantha E. Rasmussen
Department of Informatics, Indiana University
Bloomington, USA
samrasmu@iu.edu

Patrick C. Shih
Department of Informatics, Indiana University
Bloomington, USA
patshih@indiana.edu

Alice Bagley
Unity in Our Community TimeBank
Detroit, USA
uoc.timebank@gmail.com

Samuel L.A. Young
Covenant Community Care, Inc.
Detroit, USA
syoung@covenantcommunitycare.org

Tiffany C. Veinot
School of Information, University of Michigan
Ann Arbor, USA
tveinot@umich.edu

ABSTRACT

Millions of Americans forego medical care due to a lack of non-emergency transportation, particularly minorities, older adults, and those who have disabilities or chronic conditions. Our study investigates the potential for using timebanks—community-based voluntary services that encourage exchanges of services for "time dollars" rather than money—in interventions to address healthcare transportation barriers to seed design implications for a future affordable ridesharing platform. In partnership with a timebank and a federally qualified healthcare center (FQHC), 30 participants completed activity packets and 29 of them attended online workshop sessions. Our findings suggest that promoting trust between drivers and riders requires systems that prioritize safety and reliability; yet, there were discrepancies in the ability of the timebank and FQHC to moderate trust. We also found that timebank supports reciprocity, but healthcare transportation requires additional support to ensure balanced reciprocity. We explain these findings drawing from network closure and trust literature. Finally, we contribute design implications for systems that promote trust and facilitate *relational* over *transactional* interactions, which help to promote reciprocity and reflect participants' values.

CCS CONCEPTS

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

KEYWORDS

healthcare access, transportation, mobility, design, timebanks

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1 INTRODUCTION

Approximately 3.6 million Americans forego medical care each year due to a lack of non-emergency transportation [41]. A 2013

systematic review found that 25 separate studies showed that transportation was a barrier to healthcare access among people with lower incomes [54]. Additionally, people who are racial or ethnic minorities, who are older, and who have disabilities or multiple chronic conditions are more likely to face transportation barriers when seeking care [10]. Many people living in poverty face chronic disadvantages related to transportation and have very few options to meet their basic travel needs [66], which is essential to their health. Lack of transportation has been linked to lack of regular medical care, uncompleted referrals or follow-ups, appointment cancellations, and no-shows [28, 37, 45, 62, 63]. Cumulatively, such challenges may result in less use of preventative and rehabilitative healthcare, greater use of emergency rooms, and worse health outcomes for people with chronic conditions [29, 54]. We must understand ways to provide equitable and reliable transportation access, especially for people experiencing financial and resource constraints.

Sociotechnical advances like real-time ridesharing services and autonomous vehicles have transformed transportation and present opportunities to serve lower-resourced communities better [20]. This research seeks to investigate design implications for better addressing the varying challenges to providing such services to these communities. From a driver perspective, investigations of real-time ridesharing services identified challenges based on race and gender-based passenger discrimination [22, 52] and a reluctance to serve lower-resourced areas because of distance and perceived safety issues [35, 44]. From the perspective of riders living in such communities, there may be challenges with digital literacy and credit access that prevent access to digital platforms [18]. In addition, some riders may hold social anxieties related to using such services, as well as concerns related to accessibility and mobility challenges [18]. Other challenges include trust—particularly due to the lack of familiarity and trust of technology platforms like Uber [18]. Thus, for lower-resourced communities, there is a particular need to consider systematically personal, group, technological, and institutional trust in the design of technologies [26, 60]. Due to these challenges, prior HCI work has suggested alternative and affordable, technology-mediated transportation models for lower-resourced communities that can build upon current informal practices of favor exchange and resource pooling [19, 20]. In such practices, people with vehicles provided rides to those without them, especially for purposes such as healthcare appointments. However, this research also revealed challenges with interpersonal approaches to sharing rides, such as difficulties matching driver schedules and concerns about reciprocity between drivers and riders.

Contributing answers to questions raised in this past work, HCI research has aimed to identify factors to address some of the aforementioned barriers to digitally-mediated trust and reciprocity in the context of transportation and timebanking [19, 50]. We contribute to this work by uncovering specific details regarding what it might mean for technology to strengthen trust and reciprocity in ridesharing, specifically in the context of healthcare transportation. We draw from past HCI research investigations of organizations as intermediaries as a way to build interpersonal trust and reciprocity [19]. Related research proposing new models for transportation among populations living in lower-resourced areas have proposed timebanks as a potential solution to address many of the trust and reciprocity-related challenges that exist in this context [19, 20]. Timebanks, community-based non-specific voluntary services that encourage exchanges of services for "time dollars" rather than money [65], may help to address trust by connecting people through membership, community events, and ongoing exchanges. Timebanks do not rely on monetary compensation and are meant to help those with lower incomes [47]; thus, timebanks are inherently affordable. However, prior research has also surfaced challenges in operationalizing the reciprocity principle in timebanks. One challenge is that people may be hesitant to spend hours, in part due to lack of a large enough base of participants to provide variety in available services in exchange [4]. Shared transportation offers one potential for broadening services. Given the significant needs for transportation for health-enhancing resources such as healthcare [36, 54, 61], it makes up a significant proportion of exchanged services in timebanks [50]. However, as a use case, transportation introduces potential reciprocity challenges for time dollars as service payment given its necessary use of material goods such as gas and vehicles to provide rides. Furthermore, safety concerns regarding riding in a car with someone else [19], and now within a global health pandemic, may test the current exchange-based trust facilitated by timebanks. Thus, to generate HCI design implications that inform the design of (1) affordable alternatives to real-time ridesharing, and (2) timebanking applications to foster trust and reciprocity between drivers and riders, this research aims to investigate the following research questions:

- *RQ1: How can shared mobility systems in the context of a timebank be designed to promote trust between drivers and ride recipients in lower-resourced communities?*
- *RQ2: How can shared mobility systems in the context of a timebank be designed to promote reciprocity between drivers and ride recipients in lower-resourced communities?*
- *RQ3: What are the potential roles of intermediaries for supporting trust and reciprocity in shared mobility systems in the timebank context?*

We held a series of online workshop sessions with Detroiters who were recruited by either one of two intermediaries: 1) a local timebank or 2) a federally qualified healthcare center (FQHC) to address these research questions in the context of transportation to healthcare appointments. Participants consisted of drivers (i.e., people who have provided rides to others in the past in any context) and riders (i.e., people who received rides from others). We find that promoting trust between drivers and riders requires that shared mobility systems address safety and reliability concerns. Trust for transportation-related exchanges was made possible by the formation of dense social networks that lasted over time; these made trust based on personal observation and reputation possible. Our findings uncover discrepancies between the two intermediaries' abilities to moderate these trust-related factors. Specifically, historical exchanges inherent within timebanks better foster trust than non-timebank intermediaries lacking similar traces of historical exchange or similar opportunities to form relationships. However, both types of intermediaries were seen to hold potential for further supporting trust based on certifications. Our contributions to HCI are as follows:

- We address previous shortcomings in healthcare transportation literature by investigating technology-based interventions that center equity and healthcare access for lower-resourced individuals and communities;
- Empirical insights confirming past HCI timebank research that identifies concerns about balance in exchanges (reciprocity). We extend this research by contributing insights regarding alternative forms of payment both "beyond money" and "beyond time dollars" that might address such reciprocity concerns, as well as the potential contribution of relational (as opposed to transactional) values and technology-facilitated negotiations;
- Drawing from broader reciprocity, network closure, and trust literature, we show how intermediaries can play a role in developing the trust necessary for transportation and in fostering balanced exchange by providing collective resources (e.g., car seats, resources for vehicle wear and tear);
- We contribute concrete design implications for systems that promote *relational* over *transactional* interactions, and that foster trust, alignment of expectations, and balanced exchange. Our implications contribute to an expanding area of timebanking research (e.g., [4, 24, 50]) by informing the design of future timebanking systems.

For transparency, while our research was conducted within the first year of the COVID-19 pandemic, we do not present this as a main thread of the work. All participants referenced their experiences receiving rides prior the pandemic. The research team asked hypothetical questions related to the pandemic to better understand how transportation might need to change in the future, which we explicitly reflect upon in our results.

2 RELATED WORK

We begin our related work by discussing the impact of transportation and on healthcare access, and equitable transportation and its facilitators in HCI. We then discuss timebanks as a potential way to provide the infrastructure necessary to overcome reciprocity- and trust-related barriers to achieve equitable transportation in an lower-resource environment.

2.1 Transportation and Healthcare Access

In addition to lack of regular medical care, uncompleted referrals or follow-ups, and appointment cancellations [28], transportation barriers are also linked to "no-show" appointments for healthcare organizations [16, 28]. These are costly for healthcare organizations since they involve healthcare providers who are ready to provide care and are unable to do so because the patient is not present [3, 30]. Reminders via phone, text, or email have been shown to be effective in reducing the proportion of no-shows, but they are only effective for no-shows rooted in forgetting about appointments [30, 42, 53]. Other no-show reduction approaches such as algorithmically-determined scheduling and penalties have been proposed [2, 3, 27]. Still, they incur costs such as longer wait times and disincentives for seeking care [33, 49]. Where transportation is the underlying reason for missed appointments, these approaches also do little to remedy the problem long-term.

Door-to-door service can be important for healthcare transportation, as patients may experience mobility limitations due to age or infirm. Paratransit, which is typically delivered via vehicles that transport multiple people, offers such door-to-door service. However, paratransit in the United States is a publicly-funded service for people with disabilities and older people paid for by programs such as Medicaid. Hence, prior work showed that paratransit's eligibility requirements left many people unable to access it [19]. In addition, service reliability is a major concern, with participants raising concerns about lateness, long wait times, and non-arrival [19]. Some organizations, such as our FQHC partner, may purchase a vehicle and have staff pick up patients without transportation for their appointments. But at the FQHC's account, this approach is severely limited by inefficiency, cost, and distance and thus is used infrequently. Furthermore, recent experiments with shared mobility services such as Lyft and Uber at local FQHCs have shown this approach to be cost-prohibitive due to unanticipated price fluctuations, of which they are only made after the fact. Recent experience in Detroit in the context of food access also shows that if ride distances are not long enough, they may prove financially unattractive to drivers [19]. This suggests another potential barrier if the patient does not live a long distance from the healthcare facility. Past efforts to use Lyft and Uber for healthcare appointments in rural areas also failed due to a small number of drivers [56]. Hence, there is a need for reliable door-to-door transportation models that reach the many ineligible people for paratransit, engage local resources, and are financially feasible for healthcare organizations.

While equitable transportation access is perceived as a human and civil right in the U.S., specific groups that experience marginalization (e.g., people with disabilities, the elderly, lower-income, and some rural populations) experience limited transportation choices. As we see, such limitations pose challenges to basic resource access such as access to healthcare needs, but also access to food and employment [36, 54, 61]. As such, transportation is often viewed as a social determinant of health and a social need to be addressed by healthcare systems.

2.2 Models of Equitable Healthcare Transportation and HCI

Past HCI literature confirms that transportation challenges vary across groups and settings. However, HCI research is extending this descriptive research by identifying specific facilitators that can support transportation models targeted to the needs of marginalized groups living in lower-resource areas. Dillahunt and Veinot's work highlights community strengths and what worked among low-income Detroiters experiencing limited transportation access to employment, health care, and to healthy foods [19]. Drawing from four empirical studies and two case studies, they found that those transportation models falling into the "interpersonal" category posed the fewest barriers. Interpersonal models, common for healthcare appointments, included favor-based modes of transportation (e.g., people lending their vehicles to others) and resource pooling (e.g., sharing rides and/or vehicle upkeep with others) [19]. Access to caring social networks, balanced interpersonal reciprocity, and matching schedules facilitated such interpersonal transportation models. The authors proposed a "generalized favor-based model"

to sustain and expand the reach of the exchange of favors [19], which would incorporate both volunteerism and the exchange of rides for other valued resources. Building on this work, Maestre et al. conducted surveys and interviews with rural-dwelling people living with HIV and their case coordinators [20]. The authors found that the most salient facilitators to transportation included extensive support networks involving light reciprocity, and support from non-profit health organizations. Based on this work, the authors proposed that a "generalized favor-based model" might also be successful in a rural environment. While alternative infrastructures could support the generalized favor model proposed in these two works, the present study specifically explores timebanks as an infrastructure since they already facilitate indirect resource exchange.

In these previous studies, extensive and caring support networks, as well as organizational intermediaries, facilitated interpersonal exchanges involving transportation. For example, within supportive social relationships, Maestre et al. found that forms of "light reciprocity" or no payment as compensation for rides occurred. [20]. This can be contrasted with prior work suggesting that people seek balanced reciprocity, and resist the possibility of overbenefiting in ties with others (i.e., receiving more support and aid from others than they give in return) [58]. However, imbalances are more likely to be accepted in close relationships or those in which there is a history of reciprocity [31], suggesting that immediate reciprocity may be expected when such individuals cannot provide transportation. Aside from close relationships, organizational intermediaries also facilitated transportation for lower-resourced individuals. Grocery stores and local non-profit organizations also helped to address infrastructure gaps given uneven access to smartphones and data plans in lower-income urban environments. Non-profit health organizations helped to facilitate trust among people living with HIV, and managed reciprocity concerns by assigning paid staff to provide rides.

2.3 Timebanks and Other Nonprofits: Reciprocity- and Trust-building Alternatives for Equitable Healthcare Transportation

Researchers and policymakers have suggested that non-profits can assist in providing equitable transportation. One potential nonprofit type for this is a timebank, which is a non-specific voluntary service exchange that encourages the exchange of idle resources within a community and that fosters community building [65]. Timebank members earn "time dollars" for providing services to others and can then spend these time dollars to obtain services for themselves [4]. A key aspect of timebanks is that they value time equally: an hour-long drive taking someone to a doctor's appointment is equivalent to an hour spent preparing income tax forms in that both earn one hour of time dollars. Like Uber and Lyft, timebanking software helps mediate these exchanges; however, most times, timebanks are run by local non-profits instead of for-profit corporations.

Because timebanks are community-based, they might eliminate driver reluctance to serve poorer areas and safety issues raised in past transportation research. While they do require some level of digital literacy, the non-profit organization as an intermediary could potentially mitigate these concerns by members exchanging computer instruction as a service. Because timebanks do not rely on monetary currency, they might also alleviate issues related to limited money and credit access among lower-resourced populations. Profiles of timebank users' demographics show that the most active users do not have full-time jobs and have lower incomes [13, 34, 48]. By facilitating indirect exchanges of services, timebanks broaden the potential number of available drivers and thus may help reduce documented temporal mismatches and concerns about burdening specific individuals with transportation requests [19]. By encouraging all members to both give and receive, timebanks may also make it easier to "ask for help."

Nevertheless, there are difficulties with reciprocity in timebanks. Shih and colleagues discovered that the motivations for giving and receiving differ in timebanks [50], and that timebanks tend to be driven by offers of services rather than service use. They have thus proposed timebank design solutions such as facilitating donation of hours to organizations and other individuals, as well as emphasizing participation rather than one's balance of hours [4]. These recommendations have been partially implemented in the hOurworld platform, one of the main international networks of timebanks. A further issue is that people may hesitate to spend hours partly due to a lack of variety of services offered [4]. Due to significant transportation needs, Shih and colleagues' research showed that transportation represented a significant proportion (12.6%) of transactions in hOurworld timebanks in Portland, Maine, Los Angeles, California, and Milwaukee, Wisconsin [50]. However, very few timebanks are targeted specifically to transportation needs. We posit that such targeting will lead to increased transportation-related exchanges—especially when targeting lower-resourced environments. Yet, transportation as a service does pose difficulties for the timebank model of reciprocity because it involves expenditures of money for gas and upkeep (e.g., oil changes) and the use of personal assets such as cars. The present study investigates some of the reciprocity challenges of transportation as a use case. It also investigates potential roles for technologies and organizational intermediaries in fostering the reciprocity necessary for transportation exchange.

Finally, timebanks may help to address trust-related issues that could otherwise stand in the way of exchange. Trust is defined as a "bet about the future contingent actions of others," or behaving "as if" we know the future actions of others [55]. Accordingly, trust involves judgements about the trustworthiness of other people. [55]. Furthermore, trust can be accorded to institutions as well as people [55], suggesting that the timebank itself may affect willingness to trust. Trusting is also linked to contexual factors [55], and timebanks may facilitate trust by creating a context in which people know one another and hold one another accountable for the services exchanged [19]. Research literature suggests that social capital, and the trust it contains, is created in part through *network closure* [11], and another through social networks marked by *brokerage*. Theories regarding network closure suggest that because everyone is connected within a network, no one can escape the notice of others (i.e., the network is dense or hierarchical, where all are connected to powerful actors at the center of a network) [8]. In other words, the network fosters trust because actors are aware of, and enforce penalties for, misbehavior. Coleman [12] has argued

that network closure allows common norms to emerge that introduce the possibility for sanctions or rewards for non-normative or normative behavior, respectively. Notably, organizations may foster the development of network closure, as with Coleman's example of children who attend Catholic schools [12]. This social network structure, and attendant norms, may make it less risky for people to trust others within the network. By contrast, a brokerage involves an intermediary that connects unconnected parties [8]. Many prior HCI investigations of how technology can address transportation challenges among people experiencing marginalization have focused on the digital platform as an intermediary; that is, the brokerage model. Relationships among riders and drivers in digital platform brokers like Uber and Lyft do not exist in the same capacity, which could explain the distrust described in prior work among lower-socioeconomic riders [18]. As organizations that may foster networks between members, timebanks offer an alternative trust-building approach to commercial platforms as brokers. Drawing from questions raised in past timebank literature, we also investigate opportunities to operationalize reciprocity in timebanks as an intermediary and explore potential reciprocity challenges for time dollars as service payment.

Additionally, to further interrogate the potential roles of intermediaries in supporting trust and reciprocity, for shared transportation, and to address our use case of transportation to healthcare appointments, we include a second intermediary in our study. This intermediary is a non-profit, faith-based healthcare organization that provides medical care to lower-resourced community members–particularly those who have means-tested public health insurance (Medicaid) or who are uninsured. This organization is particularly motivated to address transportation for its patients because almost a third of patients miss their healthcare appointments ("no shows")–often due to transportation challenges. In this study, this healthcare organization served as both a recruitment site and as a focus of data collection such that participants were asked about their perceptions of potential roles for that organization in shared transportation. Accordingly, based on participants' perspectives, we compare two types of intermediaries in their capacities to promote reciprocity and trust.

3 REGIONAL AND STUDY BACKGROUND

To address study research questions, we followed a community-based participatory research approach [59] in which we partnered with two non-profit organizations facilitating transportation in underserved communities in Metropolitan Detroit. These non-profits were also known to provide non-traditional transportation services in the community. For background context, we describe the socio-demographic context of Metropolitan Detroit and provide an overview of these two organizations. The University of Michigan's institutional review board (HUM00166267) approved our study and determined the risk level to be "No more than minimal risk."

3.1 Study Context

Detroit is a large mid-western city in the United States that is approximately 138 square miles and has a population of 670,000 people. Approximately 77% of the city is Black, 11% White, and 8% Hispanic [5, 6]. The median household income is approximately $34K and almost 31% of people live below the poverty line. The city consists of 52% women and the median age is 35. Approximately 33% of Detroiters do not own cars [23] and those who do own cars spend up to 36% of their income on car insurance [14]. Thus, individuals facing financial constraints are less likely to own cars and if they own them, might do without driving them–thereby limiting their ability to access health care appointments [14].

Prior research has further outlined community-level factors driving Metropolitan Detroit's healthcare transportation challenges. This research includes healthcare provider shortages and extended distances to healthcare providers alongside unreliable public transportation [14, 19]. Furthermore, regional transit to travel is limited, and efforts to improve mobility between Detroit and its suburbs have been defeated. This limits Detroit residents' access to primary and specialty health care [19]. Media outlets have outlined how these transportation challenges, including the lack of regional transit, are shaped by the racism embedded in the structures that govern the city's transportation system [51]. Such injustices necessitate novel approaches to providing equitable access to healthcare transportation and healthcare as a whole.

3.2 Research Partnerships

One partner in the study was a local timebank serving several adjacent Detroit neighborhoods, and that is part of a larger, national timebank network. To join the local timebank, applicants must provide their contact information (i.e., name, address, state, zip code, date of birth, and phone number). There are 700 members of the timebank, with an average of 300 participating in exchanges per year. The timebank has been in existence for over a decade. Members include community members, professionals, and organizations (businesses and non-profits) that participate as individuals. All new members are required to attend a short (less than 1 hour) orientation. A coordinator works for the timebank; her responsibilities include organizing timebank events, raising funds, creating communications for members through emails, texts, and a newsletter, and supporting the recruitment and orientation of new members. The timebank often holds parties and other events to promote the trust needed for timebank transactions.

The partnering federally qualified health care (FQHC) center is a faith-based (Ecumenical) charitable non-profit Community Health Center serving the people of Metro Detroit. The organization has six clinical sites in Metropolitan Detroit, offering medical, dental, and behavioral regardless of one's ability to pay. The organization provides healthcare services to 20,000 people each year. The organization is interested in facilitating improved access to healthcare appointments for its patients. It has tried several approaches to offering transportation services. These approaches have included providing a staff member to pick up patients, which was found to be unsustainable. More recently, ridesharing services have been used, but the pricing model has led to unpredictable and at times exorbitant costs for the FQHC. Accordingly, the FQHC is motivated to discover new models for healthcare transportation for its patients.

4 RECRUITMENT STRATEGY

With the aid of our partnering organizations, we aimed to recruit people 18 years and older who lived or worked in the metro Detroit

area and were members of the local timebank or FQHC patients who were patients at two clinical sites in the areas served by the timebank. Furthermore, we screened for participants who had problems with transportation access at some point in time, or had given rides to other people who needed them. Screening allowed us to involve and identify both riders and drivers to participate in data collection.

Potential participants from each organization completed a 5-6 minute pre-screener used to determine eligibility for sessions. In addition to screening for the criteria mentioned above, survey questions assessed participants' access to transportation resources, needs, and demographics. We described these sessions to the participants as "group interviews." Our goal was to conduct at least six sessions (3 for potential drivers in a potential new transportation service and 3 for its potential riders). We considered those who had access to a vehicle, a valid driver's license, and provided transportation to others in some context in the past as "drivers." "Riders" did not have vehicles and/or a license, and were people who had at some time relied upon others for transportation. Activity packets asked questions that required participants to speak as riders and drivers regardless of their roles.

We funded our community partners to manage recruitment, and they each implemented strategies to match their potential participant populations. The local timebank recruited through a study advertisement, which included a link to the pre-screening survey, on their website and in their "approximately weekly" e-newsletter; 737 people are on this email list. The timebank also shared information about the study via social media (e.g., Facebook and Instagram) and sent a message to 197 members via their bulk text system. The timebank coordinator also reached out directly to 30 timebank leaders, active members, and those who requested transportation to timebank events or had exchanged rides through the timebank. The timebank staff member also reached out to a local organization focused on families with children because the timebank community skewed more toward seniors, and the research team anticipated that this group might have unique needs (e.g., car seats, child safety). This resulted in two timebank-recruited participants who did not have timebank experience in one rider session. These individuals are identified as "without timebank experience" when quoted in the results. In total, 22 participants registered and attended the timebank sessions although at least one attendee attended but did not register and at least one attendee who registered did not attend the session.

The FQHC sent a broadcast SMS message with a link to the pre-screening survey to 2,763 adults (18+), English-speaking patients from the two clinics. The research team followed up via phone and/or email to invite the 54 eligible participants who completed the screener to participate in the study. In total, 13 of these individuals registered to participate in a session, while seven ultimately attended.

5 DATA COLLECTION AND ANALYSIS

Data collection took place from November 2020 - May 2021. While participants were geographically located in Detroit, Michigan, we modified our initial plans to hold in-person workshop sessions and held them remotely to maintain social distancing and COVID-19 protocol recommendations and IRB guidelines. However, we do not frame our results within the context of the pandemic because our questions primarily focused on rider and driver experiences prior the pandemic. Nevertheless, we asked some questions related to COVID-19 to better understand what factors to address in the future and explicitly state this within our results.

Inspired by past work extending participatory design methods to remote and virtual settings [25], we printed and distributed "activity packets" to our community partners who gave them to registered workshop participants. Registration consisted of an online consent form and a link to a demographic survey (e.g., race/ethnicity, level of education, date of birth). Workshop attendees pre-completed the registration before each session. Participation included: (a) completion of activity packets before (b) virtual, two-hour Zoom workshop sessions, which were designed to complement one another, and (c) returning completed activity packets to the research team. For compensation, we mailed participants a $50 electronic gift card for full completion or a $10 gift card for partial completion.

5.1 Activity Packets

Here, we provide a brief overview of our activity packets (see Appendix A for details). We constructed two activity packets for participants: one aimed at potential drivers and one for potential riders. The goals of the packets were to begin to stimulate participant reflection on issues related to trust and reciprocity in healthcare transportation, and to investigate design insights. The packets included visual illustration of how timebanks work. Figure 1 represents a sample of what was included in both packets. Participants received the packets from a community partner or research team member who delivered them to patient homes in advance of the sessions. Once they completed the packets, participants were asked to text or email their completed activity responses to the research team before the session so that they could be pre-analyzed and used as prompts for more in-depth discussion. The packet also included study details, and session logistics (e.g., Zoom links, where to email pictures of their materials, and how to contact the research team with questions). Responses to Activity packet prompts were entered into a spreadsheet to facilitate analysis.

5.2 Online Workshop Sessions

We conducted six semi-structured online workshops to investigate design implications for better addressing transportation challenges. The workshops were organized around both an interview guide and participants' activity packets, which also served as an agenda that allowed remote participants to follow along. The six sessions included three for drivers (who had driver packets) and three for riders (who had rider packets). Sessions lasted 2 hours on average. The first and last authors, facilitated the sessions, and the third and fourth authors handled technical difficulties, and answered logistical questions from participants.

Before the start of each session, researchers asked participants to have their physical packets ready. Sessions began with researchers giving a brief introduction, providing an overview of the session, and asking attendees to introduce themselves. Facilitators walked

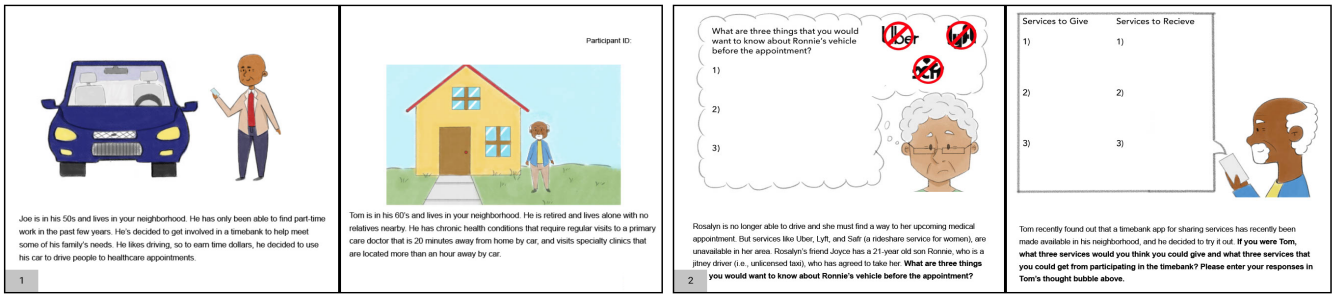

Figure 1: Select pages of activity packets that were delivered in advance to participants. These packets helped to guide participants through the online sessions. Image 1 shows "Joe the driver" and Image 2, "Rosalyn the rider"

through each question, asking participants to expand on their activity packet responses with explanations or further details. Facilitators also sought to elicit comments from participants on others' responses in addition to their own. By the sixth session, the research had reached data saturation such that no new empirical findings related to the research questions had emerged. All sessions were recorded and transcribed via Zoom and later verified by research assistants.

5.3 Data Analysis

Study data consisted of participant activity packet responses, workshop session transcripts, and demographic survey results. Our data analyses focused primarily on (a) descriptive analysis of demographic data; (b) content analysis of participant packet responses; and (c) thematic analysis of transcribed sessions. To increase validity, these two data sources were used as a form of methodological triangulation [43] to clarify ambiguous answers to packet questions, and to compare findings garnered using the two methods. In several cases, we used the transcribed sessions to clarify participants' packet responses when needed. For instance, one participant had written in their packet, "You can check their rating," as a way to mitigate concerns. Although the participant did not provide specific details to their packet response, they clarified their response in their session. In this case, the participant stressed how they trusted a timebank members' rating of someone's driving experience over a non-timebank member because they knew the people from the timebank for a long time and trusted them.

Using a content analysis approach [32], the first author, a professor with extensive qualitative research worked together with two undergraduate research assistants, and a first-year doctoral student (authors 5-7) to inductively and deductively categorize the exchange of services mentioned in the activity packet responses using an established typology of timebank service exchange [50] (e.g., food preparation, transportation, maintenance and repair, tutoring, etc., shown later in Table 3.) We reviewed the session transcripts for clarification when questions arose about packet responses and met weekly with at least one professor (author eight, an expert in timebanking system, or the last author, a senior professor with extensive qualitative research experience) and research assistant to resolve disagreements and seek further clarification when needed.

To analyze workshop session transcripts, first-round coding involved provisional coding [46], starting with an initial list of codes from extant literature (e.g., "safety" and "trust" from [19, 20, 55]). Furthermore, first round coding included open coding [15] to inductively generate new codes in response to research questions. The first and last authors, both of whom have extensive qualitative research experience, and the last author, a published authority in qualitative research methods [1]; and two undergraduate research assistants (authors six and seven), independently coded different sessions. We then performed second round coding as part of thematic analysis [57] to examine the meaning and topics of coded data and to identify patterns. This involved review of first-round codes, collapsing or dividing them, and then clustering them around central ideas. During this phase, the last author created "role ordered matrices" [39] to compare responses by roles (riders and drivers) and by recruiting organization (timebank and FQHC). This permitted the identification of the extent to which different perspectives were present across different groups. We used NVivo qualitative software for all coding, and tables in Microsoft Word for the role ordered matrices. During analyses, we met every week to identify, revise, and categorize the resulting codes. We resolved disagreements and arrived at a stable codebook in our weekly collaborative sessions.

6 FINDINGS

6.1 Characteristics of Participants

There were a total of 30 participants who returned their activity packets and completed their demographic information (17 drivers and 13 riders), and 29 participants who attended sessions. Table 1[1] shows demographic results of those who completed their demographic survey and returned activity packets. Approximately half of the participants who completed the demographic survey ranged in age between 18-39 (50%), were predominately women (83.3%), identified as Black/African American (46.7%), and earned less than $24,000 per year (~66.7%). Only one (driver) participant reported earning more than $60,000 per year (i.e., $5,000 per month).

[1] Accessible versions of all tables are provided as supplementary materials.

		Recruited from Timebank				Recruited from FQHC		Totals
		Session 1 Drivers	Session 2 Drivers	Session 3 Riders	Session 4 Riders	Session 5 Drivers	Session 6 Riders	
Number of packets returned		8	5	5	4	4	4	30
Number of session participants		*7	*4	5	*6	4	*3	29
Age	18-39	5 (62.5%)	3 (60%)	1 (20%)	1 (25%)	3 (75%)	2 (50%)	15 (50%)
	40-49	2 (25%)	2 (40%)	0	1 (25%)	1 (25%)	0	6 (20%)
	50-64	0	0	1 (20%)	0	0	0	1 (6.7%)
	65 or older	1 (12.5%)	0	2 (40%)	2 (50%)	0	1 (25%)	6 (20%)
	Missing survey data	0	0	1 (20%)	0	0	1 (25%)	2 (6.7%)
Gender (#,%)	Female	7 (87.5%)	5 (100%)	3 (60%)	4 (100%)	4 (100%)	2 (50%)	25 (83.3%)
	Non-binary	0	0	0	0	0	0	0
	Male	1 (12.5%)	0	2 (40%)	0	0	1 (25%)	3 (10%)
	Missing survey data	0	0	0)	0	0	1 (25%)	1 (3.3%)
Race/Ethnicity (#/%)	Arab or Middle Eastern	1 (12.5%)	1 (20%)	1 (20%)	0	0	0	3 (10%)
	Black/African American	1 (12.5%)	0	3 (60%)	4 (100%)	4 (100%)	2 (50%)	14 (46.7%)
	Latino or Hispanic	0	3 (60%)	0	0	0	1 (25%)	3 (10%)
	White	6 (75%)	2 (40%)	0	0	0	0	8 (26.7%)
	Multiple Ethnicities	0	0	1 (20%)	0	0	0	1 (3.4%)
	Missing survey data	0	0	0	0	0	1 (25%)	1 (3.4%)
Total monthly household income (#/%)	$0 - $1,000	1 (12.5%)	2 (40%)	2 (40%)	2 (50%)	2 (50%)	1 (25%)	10 (33.3%)
	$1,001-$2,000	2 (25%)	0	3 (60%)	2 (50%)	2 (50%)	1 (25%)	10 (33.3%)
	$2,001-$3,000	4 (50%)	0	0	0	0	0	4 (13.3%)
	$3,001 - $4,000	1 (12.5%)	1 (20%)	0	0	0	1 (25%)	3 (10%)
	$4,001 - $5,000	0	1 (20%	0	0	0	0	1 (3.3%)
	More than $5,001	0	1 (20%)	0	0	0	0	1 (3.3%)
	Missing survey data	0	0	0	0	0	1 (25%)	1 (3.3%)

Table 1: Participant Demographic Table (*Note that some participants attended sessions but did not turn in their packets or provide demographic information, while others have turned in packets but not attended sessions).

6.2 RQ1: How can shared mobility systems in the context of a timebank be designed to promote trust between drivers and ride recipients in lower-resourced communities?

As we detail below and in Table 2, participants identified several concerns with sharing rides with a stranger, some of which aligned with concerns of public and private transportation noted in prior work [19]. Similar problems were safety-related, which included perceived risks of crime. However, previous work did not note driver safety, skill, and financial and health-related risks. Concerns also focused on reliability, specifically the risk of missing or being late for healthcare appointments. While missing or being late was a concern with public and private forms of transportation like taxis, our participants linked their concerns to risks of vehicle malfunction, which extend findings from prior work. Participants also outlined how enhancing trust could mitigate their concerns. Currently, participants relied upon firsthand observations or personal memories, and reputation to build trust in potential riders or drivers. Salient reputation information for such judgements included certifications and recommendations from others.

6.2.1 Safety-related concerns. Participants expressed concern about several potential risks regarding providing or receiving healthcare transportation through the timebank.

Risk of crime One major concern was *fear of crime*, which was salient because driving may involve being in a car with an unknown person. Women, both drivers and riders, articulated concerns about sexual harassment or violence when sharing rides with unknown people. These concerns were often based on negative experiences that they heard about from others. For example, a timebank driver expressed concern about driving unknown people because,

> *"I drove for Uber a little bit. On the Facebook page, there was a lot of stories...people would just warn people like, 'this guy, he requested a ride and he's already messaging before I even get to the point that he's super horny and blah blah blah' "* (W2-9)

Such concerns led one woman driver to say that she was concerned that,

> *"...'is this person really need a ride or they just trying to get me in a car alone?'...as a woman, I would feel way more comfortable giving a ride to another woman than giving a ride to a stranger that's a man."* (W1-4)

For risk of crime, a related worry among riders was that a driver could learn their address due to picking them up or dropping them

Types of Concerns	Subtypes of concerns	Examples of Responses from Activity packets
Safety-Related Concerns (n=40 responses)	Risk of crime	Being taken advantage of or robbed
		Will she try to hurt me or force me to pay her?
		Untrustworthy person knows their address
	Driver safety and skill	Do they have a valid license?
		How good of a driver she is
		Will she get me to and from safely?
	Financial risk	Car insurance
		Does she have insurance?
	Health risk	Are they contagious with any illnesses? (like COVID-19)
		How they feel
Reliability-Related Concerns (n=19 responses)	Risk of missing or being late for appointments	Won't be on time
		Will she actually show up?
	Risks of vehicle malfunction	I hope the car has enough gas
		Is her car safe?

Table 2: Participant packet responses to *list three concerns that "Tom" might have getting a ride from a stranger* (n=30 participants)

off and later target. Women, older adults, and people with disabilities shared this concern and expressed a sense of vulnerability to this. One timebank rider said,

> *" 'Is someone that I can feel sure won't try to exploit whatever knowledge they learn about me' as they pick me up and take me riding...[they would know] where I live, my circumstances, that I am a senior person who may have some medical issues who may be frail or may be weak...there's a possibility that you see me as a person to prey upon..."* (W4-18)

Fear of crime was also related to concerns about legal risks (i.e., having a person carrying drugs or a weapon in the vehicle, or riding in a car that the driver had stolen). Per an FQHC rider, *"[the car] could be stolen...they could have somebody's car without their permission and driving around in it..."* (W6-P28)

Driver safety and skill Personal safety concerns also extended to *driver safety and skill*. These concerns dealt with whether the driver had a driver's license and driving behaviors that increased the likelihood of accidents. This timebank rider said they wanted, *"...what I consider a safe driver...so basically someone that doesn't speed, or have road rage..."* (W3-P6). As mentioned in the previous quote, several participants from both the timebank and FQHC were concerned about negative confrontations due to road rage or aggressive driving. Other participants, such as this FQHC driver, worried about potential distracted driving, *"...if I'm riding with someone that doesn't really pay attention when they're driving, if they're texting while they're driving..."* (W5-P23)

Financial risk Financial risks were another type of concern expressed in sharing rides. Financial risks primarily related to insurance and liability in the event of an accident. This was particularly a concern given the prevalence of driving without insurance in Detroit, as this timebank rider explained, *"...a lot of people are driving without insurance because of the high rate of insurance in Detroit."* (W4-P19)

Given this concern, participants from both the timebank and FQHC advocated verification of insurance for drivers offering transportation through the timebank. This timebank rider said that the timebank should check *"The insurance papers, showing that it's covered."*(W4-P18)

Health risk We conducted this research during an active COVID-19 pandemic in the United States. Some participants indicated that they had stopped using ridesharing through the timebank or other organizations due to fear of the virus. For example, when asked if she was still getting rides from timebank members, W3-P6 said, *"I am not. Mostly for concerns for myself and the people that I live with."*

Therefore, the research team asked participants about their perspectives regarding accepting rides during the pandemic, and what might make them feel safe. In response, participants overwhelmingly expressed hesitations about whether the drivers and participants were both wearing masks. As a timebank driver said, *"...one of the important things is, is my passenger wearing a mask and am I wearing a mask?"* (W3-P14), which was a perspective echoed by several others from both the timebank and FQHC. Participants from both organizations also highlighted the importance of sanitizing the vehicle between riders.

Additionally, participants like this FQHC driver suggested that drivers have supplies on hand for riders, which might make them feel safer, *"...having hand sanitizer easily available... maybe having face masks available should you not have one at the beginning of the ride."* (W6-P27) When asked about whether they wanted the driver or rider to be vaccinated, however, timebank participants indicated discomfort with asking people to disclose health information.

6.2.2 Reliability concerns. Per Table 2, a number of participants also surfaced concerns about service reliability. These concerns primarily focused on risks of missing or being late for appointments and risks of vehicle malfunction.

Risks of missing or being late for appointments According to participants, there was a non-negligible cost to them if they did not get their appointment and on time. Lateness typically meant having to wait longer for their appointment. Missing appointments altogether was problematic if someone had waited a long time to get their appointment, and because some healthcare organizations charged them for "no-show" visits. For example, this rider without timebank experience said,

> *"'The doctors trying to charge us $25 if we don't show up for our appointments while we're dealing with transportation that's provided by the insurance company...and we don't get there all the time. That's not on us...I can't even afford a car and get a ride to the doctors, how am I gonna pay $25 for a missed appointment?"* (W4-P20)

A couple of participants had also experienced drivers that did not show up to take them to or from an appointment. For example, W4-P20 described getting stuck at their doctor's office because their scheduled ride never came, and borrowing money from others to get home.

Risks of vehicle malfunction One of the major factors contributing to potential lateness or missed appointments was the condition of the vehicle, and possible vehicle malfunction. Participants' experiences with vehicle malfunctions when using their current transportation services formed the basis of their worries. One timebank rider explained that in a recent ride,

> *"'...we had to stop at a gas station so I was late for my appointment. So when I get to the appointment, if you don't keep your scheduled time at the doctors' offices, they cancel so you have to reschedule. So that's [a] very bad inconvenience."* (W3-P15)

In the face of such experiences, participants wanted to know that the driver had enough gas before picking them up. They also expressed concern about other types of vehicle problems, such as malfunctioning brakes or bald tires in winter, which increased risks of accidents. Thus, they wanted to know about the condition of the vehicle before riding in it,

> *"I would have questions about the safety of the vehicle...has your check engine light been on for eight months or like do you have air in the tires...vehicle safety stuff..."* (W2-P10)

6.2.3 Enhancing trust to mitigate concerns. Trust allows people to behave as if they know how someone will behave in the future. Therefore, trust was a critical factor that could mitigate participants' concerns about sharing healthcare-related rides with people whom they did not already know. Following sociological trust theory [55], we found that participants highlighted traits of the person being trusted that would mitigate the aformentioned concerns about potential risks.

Participants' responses regarding the traits that they would look for in a potential driver and/or rider fell into categories found in sociological trust theory [55]. These involved *first-hand observations or personal memories,* and relying upon information sources concerning an individual's *reputation.*

First-hand observations or personal memories Both timebank and FQHC participants indicated that they may feel more comfortable getting a ride from a person whom they met or–even better–got to know personally. Primarily mitigating concerns about crime risk, this contact with another person allowed them to develop personal, *first-hand observations or personal memories* of that person. Timebank participants in particular indicated that meeting someone in person would allow them to develop an impression of a person sufficient enough to decide whether to ride with them. This timebank driver said that after meeting the person at a timebank event, *"...it's not a complete stranger...whatever interaction that you had with that person, you will know whether or not you feel like you trust them enough to get into a car with them."* (W1-P2).

Timebank participants also debated whether meeting the person via videoconference or phone, or communicating via text, would allow them to form a strong enough sense of the person to feel safe riding with them. Across participants, the consensus was that texting was not sufficiently personal, but that either video or phone could be enough. As one Timebank driver said,

> *"I...like the idea that when they come to pick you up, it's not the first time you've met them...[a] Zoom call does that...even...a phone call, just to hear a person's voice before you're hopping in the car... I prefer the Zoom, and then the phone and an SMS because...they're probably a real person. But...I'm skeptical that it's a real person texting back. Maybe it's just all those automated web sites that are just a bot talking to you."* (W1-5)

Although they did not mention events or Zoom calls, FQHC riders and drivers also believed that advance discussion could help them feel safe with sharing rides. This driver asserted that, *"...see if you can interact with them beforehand, before getting into a vehicle by yourself, whether they're the driver or the passenger. Talking to them...see where their head is."* (W5-P24)

Reputation Timebank and FQHC participants indicated reputation could make them less concerned about sharing rides with an unknown person. These participants most commonly stated that they felt that *certifications* such as driver's licenses, vehicle registration tags on license plates, and certificates of auto insurance could mitigate their concerns about driver safety/skill, and financial risks of shared rides. As a timebank driver said, *"...most important to me is certain basic things...do you have a valid driver's license...is your car registered."* (W2-P12)

Participants differed on other types of certifications which they thought relevant. Responding to their concerns about *risks of vehicle malfunction,* two participants without timebank experience suggested that vehicle inspections should be conducted and made visible, although one timebank rider felt that this was unrealistic. One FQHC participant who had concerns about *risk of crime* related to vehicle theft wanted to see vehicle ownership papers. Another FQHC participant suggested a certificate that showed their driving achievements.

Finally, there was significant discussion of background checks to address *risk of crime* and *driver safety.* Some participants, especially

those who felt physically vulnerable, believed that background checks could help them feel more comfortable riding with someone. For example, this disabled timebank rider said, *"...do they have a background check?...have they robbed somebody before, or sexually assaulted anybody."* (W4-P19)

However, other participants who thought it was important to not use a blanket background check and instead focus only on highly relevant items that could be revealed in a check, as this timebank driver said they would consider, *"...if you've had a driving related- like a DUI...I'm not sure about that...[but] that's very very relevant...to...driving safety skills."* (W2-P12)

Still others felt that background checks should not ever be used since this could exclude people from the timebank. Others who opposed use of background checks highlighted the ability of people to change, like this timebank rider,

> *"..Sometimes we just do stupid things in our youth...so I try not to hold that against anyone so I'm not so concerned about the criminal background...because evidently if they have a driver's license and they have insurance, they're responsible enough to have those things."* (W3-P14)

Recommendations from others are a second source of information of importance regarding reputation, and both timebank and FQHC participants referred to use of them. As might be expected, recommendations were thought to be more powerful when from people whom they knew personally. For instance, timebank rider W4-P12 said they would feel more comfortable accepting a ride if *"I knew someone who knew the driver."* However, a few timebank members clarified that they would be more likely to rely upon their recommendation if they respected that person's opinion or trusted them.

With respect to recommendations from people they did not know, participants stated that they would look at other cues to determine trustworthiness. In an online context, numbers of positive reviews from different people would garner greater faith. Negative reviews would be assessed for commenting history from that user, or content to determine whether to take it seriously. However, several participants stressed that they would be more likely to avoid a driver if any safety concerns were mentioned. As this timebank driver explained, she would assess online reviews of someone as follows,

> *"...if the review was 'this person drives like a crazy person and I felt unsafe' or 'they were really creepy and asked me scary questions'...that's different than 'they were chatty.'"* (W1-P4)

6.3 RQ2: How can shared mobility systems in the context of a timebank be designed to promote reciprocity between drivers and ride recipients in lower-resourced communities?

During the sessions, we asked participants about issues that could challenge reciprocity in a timebank model: the costs that drivers using their own vehicle would incur for gas and vehicle upkeep. In response, most participants acknowledged challenges in creating balanced exchanges, or reciprocity, for transportation, although the timebank would track driving time as hours. As one longtime timebank participant explained:

> *"...an important tenet of the timebank is that everyone's hour is the same, worth the same amount... perhaps chip in for gas...It's in the same way if like you ask someone to bake cookies for you..you might give them a little bit of money to buy the ingredients for the cookies...you're asking for more than just their time, you're asking for something that actually does cost something...maybe [it] would make it a bit more fair..."* (W1-P4)

Similarly, FQHC participants, who did not have timebank experience, appreciated the concept after learning about how they work. Several participants indicated a potential interest in future participation. However, they also expressed concern about out-of-pocket costs for gas and vehicle wear and tear. As this driver said, *"...if they're using my vehicle, and I'm helping them, [they should pay] the difference in the gas...I gotta get the gas money from somewhere..."* (W6-P28)

Given these out-of-pocket costs incurred for transportation, participants identified four main strategies for managing the potential imbalance in exchanges to make the provision of transportation more "fair." These include *light reciprocity, reducing personal costs, identifying mutual practical benefits, and embracing relational rather than transactional values.*

6.3.1 Light reciprocity. The first strategy, similar to prior work [20], can be called *"light reciprocity"*. This involves exchange of money or goods (but not services) without exact accounting of amounts spent or owed. With light reciprocity, as mentioned above, participants could offer a small amount of money to help pay for gas for a trip. Alternatively, they might buy something for the participant,

> *"I would offer the person depending on who it is. "Where would you like to maybe go out to lunch or have a light snack somewhere".....then the timebank, we do switch- if you're in the timebank and they're in the timebank, we switch the hours in that."* (W4-P19)

Frequent rides also introduced limits to *light reciprocity*; the added driver costs might necessitate payment for vehicle upkeep. Furthermore, light reciprocity had limits depending on the driver's financial situation.

> *"...[financial compensation] could be based on the driver... if it's a stretch every month to like pay for gas and oil change...that does feel different to me than someone who's like 'no I genuinely, I wouldn't notice if I like picked up this tab.'"* (W2-P12)

Light reciprocity could also be challenged when people did not feel comfortable with not giving money to a driver in return for a service, although this perspective was more common among people without timebank experience.

6.3.2 Reducing personal costs. The second strategy for participants, particularly drivers, was to *reduce personal costs* in providing transportation services. This involved considerations of distance and frequency of trips involved, as well as considering their personal comfort and competing responsibilities in providing rides. With

respect to distance, participants felt that their need for "gas money" was dependent on how far the trip was, which was a consideration that they currently employed. As this timebank participant explained,

> *"...it's about how far you're going...if the amount of gas you're using is negligible because you're going three, two miles then versus like driving...an hour away...that can add up."* (W1-P4)

Distance was also a consideration in relation to personal comfort, with some participants expressing a desire for short trips due to not enjoying driving, with a maximum of a 30-45 minute drive articulated as a limit for all FQHC drivers. Some participants also expressed a desire to avoid trips to distant locations that were unfamiliar, and thus uncomfortable.

Participants also set boundaries around what they were willing to do on a ride in order to reduce personal costs. During the sessions, we asked drivers if they would take an extra trip to a pharmacy if the rider had received a prescription at their healthcare appointment. Here, participants stressed that their willingness would relate to whether they had other commitments, or how long the wait would be. One participant stressed, *"I think that could be...a separate booking on its own...the person be just going to pick up the medicine or knowing if there is going to have to be a wait."* (W2-P11)

6.3.3 Identifying mutual practical benefits. Both timebank and FQHC drivers also spoke about identifying mutual benefits that would make them more willing to give a ride to another person. In part, this involved finding ways to offer rides to places where the driver would already be going, in a carpooling-type of arrangement with a common destination. Accordingly, timebank participants could earn time dollars while taking usual trips. This timebank participant explained how such planned trips made her willing to travel longer distances than others, *"I think [what distances are too far to offer a ride] depends on 'do you have some sort of other business in that area?'"* (W1-P4).

In addition, in the context of healthcare appointments that involve waiting, FQHC participants believed that they could make use of the trip for errands or amusement themselves, with proper planning. As this FQHC participant said, *"...there may be something in the area that I can go and do...while I'm waiting for you to do your business at your appointment."* (W5-P23)

Furthermore, both timebank and FQHC participants felt that timebank participation itself could allow them to benefit from giving rides to others' healthcare appointments. Typically, they focused on obtaining services that they would want even without timebank participation, such as satisfying a long-term desire to learn to play the piano, or help with yard work. Table 3 shows that participants identified a number of services that they could give or receive as part of transportation-related transactions that could help them to achieve mutual practical benefits.

6.3.4 Embracing relational rather than transactional values. Participants from both the timebank and FQHC expressed strong commitments to designing a shared mobility service that expressed *relational values* rather than *transactional values*. Transactional exchanges are typically short-term and are described by monetary exchanges for an easily measured commodity [21]. Transactional interactions can be adversarial as stakeholders might grapple with what's needed to achieve the best position economically. By contrast, relational exchanges are longer-term and value relationships [21]. Such exchanges are characterized by factors including cooperation, interdependence, commitment, trust, conflict resolution and shared values.

In expressions of values, transportation-related reciprocity tensions could be either reduced or resolved by appeals to building community, developing interpersonal relationships, and expressing appreciation. For example, in response to a query about how the gas money or vehicle upkeep should be handled, this timebank driver emphasized values of *building community* over the specifics of reimbursement for those expenses,

> *"...they also want to feel...that they appreciate the ride, and I think that plays into giving some token of appreciation too...I don't know if it has to be transactional as much as it's like fellowship and just, friendship, and developing that relationship with people."* (W2-P9)

Furthermore, participants from both the timebank and FQHC emphasized *developing interpersonal relationships* as a benefit from sharing rides, with some emphasizing the value of conversations while driving, and of riders and drivers getting to know one another. These benefits were also framed as potentially more important than money, as one timebank rider said, *"...the most important thing that someone can give you is a good conversation."* (W3-P14).

Participants contrasted emphasizing interpersonal relationships instead of transactions, where there was a focus on efficiency and money instead. For example, when discussing her experiences with commercial ridesharing services such as Uber and Lyft, this timebank member complained,

> *"I feel kind of sad that when I get in and I say hello and they don't respond....you don't get the same driver consistently...I don't know what timebank would do if we would have enough drivers where we will always get used to these drivers, but that doesn't happen in the real world of share riding...[and] most drivers on tight schedules and they have to pick up other people, and they have to drop off so many people..."* (W3-P15)

As an antidote to such experiences, two participants stressed how much they would like to have a consistent driver with whom they could develop a connection. As W4-P19 said, *"It'd be nice if it'd be the same [driver]...if it's the same person, you get a bond with them."*

Finally, both timebank and FQHC participants spoke of *expressing appreciation* for rides as an important, and relational, element of reciprocity. Indeed, the second most popular form of compensation "besides money" identified through the activity packet was "gratitude." This timebank rider explained why,

> *"...show people that they mean something to you, and what they've done means a lot...the humanity side of it...money might be exchanged ...but there's no personal feeling really in an exchange of money."* (W3-P16)

Further stressing its importance, participants emphasized that gestures like smiles, fistbumps, or hugs might help to express such feelings. Indeed, an FQHC driver stated that they would not need

Service Category	Offers	Requests
Teaching, Mentorship & Skill exchange	23 (25.84%)	3 (3.33%)
Companionship	1 (1.12%)	8 (8.89%)
Grocery shopping, cooking and food	8 (8.99%)	10 (11.11%)
Home services and repair	13 (14.61%)	9 (10%)
Babysitting & Pet care	5 (5.62%)	1 (1.11%)
Transportation	7 (7.87%)	30 (33.33%)
Office skills and professional aid	7 (7.87%)	3 (3.33%)
Gardening and Yard care/work	4 (4.49%)	11 (12.22%)
Scheduling Help	4 (4.49%)	5 (5.56%)
Welfare assurance and personal care	3 (3.37%)	5 (5.56%)
Other (e.g., volunteering space, lending money)	14 (15.73%)	5 (5.55%)
Total	89 (100%)	90 (100%)

Table 3: Opportunities for Reciprocal Exchange (Based on an established typology of timebank service exchange [50])

financial compensation at all for driving, but would instead want, *"...a heartfelt thanking and a warm smile...just to see the look on the face is enough for me."* (W6-P27)

6.4 RQ3: What are the potential roles of intermediaries for supporting trust and reciprocity in shared mobility systems in the timebank context?

6.4.1 Intermediary roles in supporting trust. Intermediaries were important in supporting trust in both individuals and in the larger context/situation. Trust in individual drivers/riders was currently supported by *building dense networks that persist over time*. Additionally, for healthcare transportation, participants expressed desires for expanded intermediary roles in *verifying or providing certifications*. Furthermore, as features of the context/situation of shared transportation, participants expressed desires for *monitoring and tracking* and *using policies or procedures* for the transportation service.

Building dense networks that persist over time Timebank members' accounts showed that they developed relationships with one another, which over time grew into a dense network. In this dense network, many people knew one another, and had a history of service exchanges. Such a phenomenon was not observed among FQHC-recruited participants.

Timebank practices of hosting frequent events were important for creating initial impressions of other members. This is important since, as mentioned previously, first-hand observations or personal memories were a basis for feeling comfortable sharing rides. Demonstrating the importance of such events, this timebank driver said, *"You have, like, a feel on the person right? If you've been with them, you spent an hour or two with them."* (W1-P4)

Furthermore, longer-term relations meant that timebank members might provide enough firsthand experience with the person that sharing rides with them would feel safe. For instance, this timebank driver said he would not be concerned about driver safety with timebank members because, *"...you all know each other in the timebank very well."* (W1-P5)

As mentioned in section 6.2, another basis for trusting potential riders and drivers was reputation, with recommendations from others providing reputational cues. At a basic level, timebank participants (but not FQHC participants) mentioned that timebank affiliation could make them rely more heavily on the recommendation of another person. As this timebank rider said,

> *"...people usually join the timebank because someone that they know referred them over...if someone that they knew that referred them over to the timebank was also offering a driving service... that [would] put people at ease..."* (W4-P19)

Timebank participants like this one also highlighted that long-term relationships with timebank people would make them more likely to accept a recommendation from them,

> *"...the people that I know through the timebank, I have known for a period of time. And I trust what they're saying about things. If someone was giving a positive review [about a driver/rider], I would give that...credence..."*(W1-P2)

A type of indirect recommendation from others could also be found in the history of successful timebank exchanges in which an individual had participated. One participant said they would be more comfortable regarding driver safety and skill, *"...if I were to see that this driver... did this many rides...okay, it's not the first time they're driving someone..."* (W2-P11)

Verifying or providing certifications. Participants indicated that practices of verifying and providing certifications could come from different types of intermediaries, such as mechanics (vehicle condition), insurance companies (valid insurance), or the state government (driver's license). Additionally, participants saw roles for both the FQHC and the timebank in relation to certifications. While the timebank did not currently perform any certification functions, both riders and drivers stated that they would be less concerned

about sharing rides with someone if the timebank provided such verification. Practically, one reason for wanting the timebank to assume this role was the difficulty of asking people who were offering them a "free" ride to "prove" themselves worthy of doing so with certifications. Others stated that this was simply the expected role of an organization providing rides.

> *"I would think that if this is going to come through an organization, be it the timebank, that the timebank would make sure they had a valid license. Their car is insured. All those other papers, registration, plates are all in order, so that it would not ever become an issue if ever this person was transporting me. I don't want to be on my way to the doctors to have this person pulled over to find out that they have a suspended license or they don't have insurance."* (W4-P18)

While opinions about background checks were mixed as discussed above, there were a few participants from both the timebank and FQHC who felt that this would be an important safety-enhancing role for organizations offering transportation. As this FQHC rider said, *"I would trust that [FQHC] did [a] check...that would be my security assumption... prior to [a driver] even coming my way."* (W6-P26)

Additionally, this FQHC member said that they might trust a post on a bulletin board about a transportation service if it had a stamp on it showing that the service was approved by the FQHC but wouldn't trust it otherwise.

Monitoring and tracking Several participants also indicated that the timebank could enhance their comfort with sharing rides in a way that altered the context/situation [55]. One approach was record-keeping regarding who was participating in rides, *"...make sure that...that things are recorded so that if anything happens there's a way to go back...and know who drove who where."* (W2-P9)

In addition, there was a desire to use mechanisms such as reviews or other feedback to hold members accountable if a problem was reported. As this timebank driver said,

> *"...if people could like basically giving like a review...if there was a negative review...having a person to follow up with about that. So that there could be this level, not just of trust but like of accountability within the network."* (W2-P12)

Using policies and procedures Finally, a few participants mentioned policies or procedures as a role for intermediaries, although this was only brought up by timebank members. Specifically, this approach was thought to be one way to address risk of vehicle malfunction due to problems like lack of gas or a functioning car battery,

> *"...the facility that was hosting the transportation program [should] have a checklist. And before you go out, you kind of sign this little form saying that you have checked all of these things."* (W3-P14)

Another person felt that health risks concerning COVID-19 could be addressed by policies and procedures concerning vehicle sanitation and other practices,

> *"I think with the timebank, [there's] a lot more transparency...because it's [a] more informal place that there could be room to ensure that this is how we're sanitizing and if you want to ride with me this is what I do."* (W2-P9)

6.4.2 Intermediary roles in supporting reciprocity. Participants identified two main roles for intermediaries, particularly timebanks, in managing reciprocity challenges regarding healthcare transportation. These included *centralizing resources to maintain balance in exchanges* and *aligning expectations for exchange in advance.*

Centralizing resources to maintain balances in exchanges As mentioned above, a potential reciprocity concern in timebank-based transportation is out-of-pocket costs incurred by drivers such as gas and vehicle maintenance. While participants identified the personal strategies for managing potential imbalances described above, riders and drivers recruited from the timebank, and FQHC suggested that the timebank organization play a role. These roles included providing supplemental funding to cover frequent drivers' expenses and providing access to items needed for transportation. The wish for supplemental funding was based on desires to avoid burdens on individuals for negotiation and to ensure that frequent drivers would not experience financial strain as a result of driving for others. A timebank rider recommended,

> *"..build it in where, 'Okay, you drove this many miles for the timebank. We have some pot of money to reimburse your mileage,' rather than it having to be between the two individuals."* (W2-10)

Timebank riders also presented this idea in their sessions, but the vision was less one of direct reimbursement and more one of providing financial assistance,

> *"...if you're going to use your car and get the wear and tear on the car. I think it would be really helpful if there might be a kind of slush fund... for the drivers that need that...it will be a good faith gesture so that we know that you've been driving this many hours this month, so here's $25 at the end of the month...it's not going to cover everything, but it's a good faith gesture."* (W4-P21)

FQHC participants also advocated payment for drivers' expenses, with the additional suggestion from one that there should be a mileage formula for reimbursement, and another that the timebank should form partnerships with gas stations or mechanics to give drivers vouchers for services. Another timebank participant, W4-18, also suggested that the timebank partially subsidize drivers' auto insurance.

Unique to FQHC participants was the suggestion that drivers should earn more time dollars for driving than is typical, *"...as a driver...they should receive other services [through time dollars]... for the...ride and wear and tear on the car...you should receive more..."* (W5-P23) Notably, this suggestion was not made by participants recruited from the timebank, perhaps due to their expressed support for the equity principle that values all people's time the same. Furthermore, a timebank member, perhaps building on the existence of a tool library, also suggested that the timebank could have items needed for transportation, such as car seats for children or canes for people with mobility disabilities, that members could request.

Aligning expectations for exchange in advance Participation in the timebank helped to facilitate member exchanges in part by

aligning expectations between those giving and receiving services. The baseline expectation was that people will earn time dollars for their efforts and that all hours were equivalent. Furthermore, expectations concerning how to seek and offer services were embedded in the timebank's digital platform and the practices of members and staff. It was clear, however, that transportation could challenge current shared understandings such as whether any gas money should be paid. As one timebank rider said, *"...if the driver is expecting monetary compensation...it has to be made clear up front because if they're in a timebank, it is expected that they're not, that they're willing to exchange services."* (W3-P16)

Currently, timebank participants stated that the process of negotiating exchanges typically began on the timebank platform, where members found one another. Following this, timebank members moved to other technologies such as texting, email and Facebook messages to negotiate the specifics of the exchange. However, both timebank and FQHC participants highlighted the need for people involved in transportation-related exchanges to negotiate a number of issues in advance of the trip. Participants in both groups expressed desires to avoid conflicts and misunderstandings by ensuring clear up-front communication. Therefore, when discussing information desired in advance about the appointment or rider/driver, or in response to a range of scenarios, participants asked for features to be added to the timebank platform to facilitate this communication, resulting alignment of expectations. For example,

> *W1-P4: "...my understanding is what you're...creating an app...to connect people. I think that having that that question as one of the questions like, 'what do you expect as far as paying for gas?' Do you expect 55 cents a mile, do you expect 'no, it's okay', do you expect just five bucks or...what the driver might expect from the person."*

In addition to the benefits in making the exchange smoother, a timebank participant advocated this approach because it was hard for her to ask others for gas money, *"...it would be great if it was built into the timebank because I'm not very good at saying like, 'I need gas money,' I myself so. But if I did, or if it was just offered, that would be really nice"* (W2-P9)

Other possibly thorny issues that participants felt the system should help them understand in advance included whether there were other people such as children would be riding with them, whether the rider has mobility challenges such that they might need help getting in and out of the vehicle, and whether the rider wanted to add another trip after a healthcare appointment ride. About the latter case, this timebank participant requested,

> *"...a checkbox, like an accessory trip, stop after expected to pick up prescription. I've dropped people off at appointments and they're like 'can we stop over at [grocery store] since we're over here?' I'm like 'oh my god, of course we can stop at [grocery store]," but maybe ahead of time...you may expect you... might need something on the way back."* (W1-P5)

In addition, both timebank and FQHC participants mentioned health-related concerns that might prevent them from sharing a ride with someone, such as whether the driver/rider would wear a mask to protect against COVID-19. To protect against this, a participant suggested agreements to sign electronically that the parties agree to wear masks. Another health-related concern was whether the person wanted to smoke in the car, about which one FQHC participant said,

> *"I have a two year old so it would be important to know because [if the person smoked]...she's not around smoke at all so just a ride to and from...you can put the cigarette down...for me because you are in my car."* (W5-P24)

Taken together, it was clear that participants wanted technology from the timebank that could help them avoid unwelcome surprises and unpleasant interactions when exchanging transportation services.

7 DISCUSSION

A desire for equitable healthcare transportation among lower- resourced populations and ways to inform technology design to aid this purpose motivated this study. We provide a summary of our results in Table 4. Achieving equitable transportation in this space requires several levels of trust. In response to our first research question, we found that to promote trust between drivers and ride recipients in lower-resourced communities, shared mobility systems must unsurprisingly prioritize mitigating safety, financial, and reliability-related risks. Our results confirm prior work [19, 20] suggesting that such systems should inherently promote long-term relational over short-term transactional interactions. Technology design should aim to strengthen these exchanges. Offering ways for design to promote relational over transactional interactions is also a way to promote reciprocity between drivers and riders; this addresses findings from our second research question. In response to our third research question, we found that the timebank as an intermediary supports trust by building dense networks that persist over time. Furthermore, extending current intermediary roles, we found that participants expected intermediaries to verify or provide certifications to facilitate trust. Participants also wanted them to monitor and track and use policies and procedures to create a context in which transportation exchanges could proceed in a trustworthy fashion. For reciprocity, we found that participants wanted intermediaries to provide centralized resources to maintain balance in exchanges and to extend their role in aligning expectations to address the special case of healthcare transportation. There were differences between timebank and non-timebank members' perceptions of intermediary current and possible contributions to trust and reciprocity. In other words, in a novel finding for HCI research, we found that not all intermediaries are the same. We start our discussion by unpacking observed differences, and expanding ways to support trust for shared transportation to healthcare appointments. We conclude with concrete design implications regarding how timebanking-based ridesharing systems can further prioritize safety and reliability, and strengthen relational over transactional interactions.

7.1 Disentangling Trust within Closed Network Structures

Trust is a multilevel phenomenon [60] and a fundamental component of social relations [17]. Trust helps reduce complexity in social interactions and aids actors in their decision making, particularly in difficult or risky situations [17, 40] where key knowledge or

Research Question	Findings and Implications	Concrete Design Recommendations
(1) How can shared mobility systems in the context of a timebank be designed to promote trust between drivers and ride recipients in lower-resourced communities?	Address safety and reliability risks/concerns by fostering the development of dense social networks that last over time	- Raise the visibility of timebank interactions via "Member since" tags, number of exchanges made, date of the last transaction, or history of past events - Make visible ways for others to vet for rider or drivers' reliability and safety - Enable riders to request specific drivers and vice versa - Support online opportunities for vetting via online events, add friends feature to enable video or phone chatting before rides
	Enhance trust by supporting reputation-building and certification. Historical exchanges inherent within timebanks better foster trust than non-timebank intermediaries lacking similar traces of historical exchange or similar opportunities to form relationships	- Design for driver certifications and seals of approval (e.g., Figure 2; consider equitable ways of allowing drivers to show credentials such as licensure, proof of registration or insurance, background checks, or other forms of endorsement)
	Future investigation: *Investigate conditions in which background checks are preferred as this might be exclusive to some individuals; Investigate nuances relating to the effectiveness of reviews (i.e., reviews made by known members are likely to be valued more than reviews from strangers.)*	
(2) How can shared mobility systems in the context of a timebank be designed to promote reciprocity between drivers and ride recipients in lower-resourced communities?	- Promote light reciprocity and aim to reduce personal costs - Identify and encourage mutual practical benefits (See Table 3) - Embrace relational over transactional interactions	- Allow for rider/driver feedback and gratitude in the form of fist bumps, virtual hugs, and "on-time" and "safe" arrivals - Allow riders to specify requirements like the need for a wheelchair or car seat (e.g., Figure 3b)
	Future investigation: *Investigate conditions in which relational over transactional interactions hold. How might this change among strangers or people who have not known each other for long?*	
(3) What are the potential roles of intermediaries for supporting trust and reciprocity in shared mobility systems in the timebank context	- Intermediaries can support trust by building dense networks that persist over time. - Additional opportunities exist for intermediaries to verify or provide certifications, monitor and track rider and driver interactions, develop a set of policies and procedures for interactions.	- Allow for certifications approved by intermediaries that are issued according to predefined milestones (e.g., driven 25 members, driven 1,000 miles)
	Intermediaries can support reciprocity by centralizing resources to maintain balances in exchanges and aligning expectations for exchange in advance.	- Facilitate timebank inventory management to accommodate car seats and other necessary equipment - Encourage exchanges that might not be apparent in the timebank (i.e., Table 3) - Facilitate requests for unaccounted expenses like gas money or parking, car seats, strollers, etc.
	Future investigation: *Investigate the feasibility of intermediaries' ability to facilitate certifications or centralized resources and opportunities for technical versus socio-technical support*	

Table 4: Summary of findings, design recommendations, and explorations for future research

information might be missing [17]. Two expectation types of trust outlined in the trust literature include axiological and instrumental. Axiological trust refers to the morality of others and includes honesty, and benevolence [38, 55]. Instrumental trust concerns reliability and competence [55] and was key in participants' need to know that their drivers would get them to their appointments on time. While these two types of trust are key, our results suggest that timebanks can uniquely moderate axiological trust. While trust is seen frequently as a relation between a single individual (trustor) and another individual (trustee), it can also take on the form of collective-based trust [17]. In our findings, this was true specifically among timebank members, whose observations of others from events, persistent relationships built through exchanges, and recommendations could make them comfortable with sharing rides. In contrast, FQHC-recruited participants without timebank experience stressed roles for intermediaries in verifying and providing certifications as cues about reputations, a role that was also desired for the timebank. With respect to certifications, we see a "carryover effect" of institutional trust regarding organizations [55] like the FQHC, auto mechanics, and timebank to the certifications in question. As such, in line with sociological trust theory [55], these secondhand cues regarding individual credentials (e.g., driver's license) and institutional processes (e.g., background checks, insurance verification) became targets of trust themselves.

With respect to the unique role of the timebank, as introduced earlier, people joined the local timebank and provided their names, address, and other personally-identifying information. They also attended an orientation, and the local timebank held local events where members could interact and informally vet one another. Members accumulated timebank hours through exchanges over time; this might also signal how long members had been a part of the timebank. As mentioned, they also had access to reputation information concerning others' experiences with potential drivers and riders. Our results suggest that timebank members were looking for this information to determine whether they could trust a driver or rider. Our findings are consistent with past research that shows that trusters may gain their trust through a history of reciprocal exchanges [7]. Such interactions were not salient among

participants we recruited from the FQHC (non-timebank members), nor the two people recruited by the timebank who were not timebank members. Drawing from this research, we describe two ways for intermediaries to promote safety and reliability in healthcare transportation: **(1) vetting events and visible interactions** and **(2) driver certifications and seals of approval**.

7.1.1 Vetting Events and Visible Interactions. Our findings suggest that the timebank was a trusted institution [55] and that due to its dense and persistent network, those associated with the timebank were likely to be perceived to be more trustworthy than non-timebank members. To build networks, the timebank hosted opportunities for interactions, which gave people opportunities to develop first-hand observations of one another. Our participants referenced these events in the workshop sessions as a way to vet potential drivers/riders. Additionally, participants wanted to access recommendations and descriptions of others' prior experiences with a potential rider/driver like traditional reputation systems. However, in contrast to conventional reputation systems, participants wanted the total number of timebank transactions disclosed in a potential timebank-supported rideshare system as a way to uncover a person's tenure within the community. Making prior transactions visible is another form of recommendation, one based on tracking, which is another facilitator of trust [7]. Indeed, some timebanking platforms include a "Member Since" style reputation tag and show the number of exchanges made and the date of the last transaction. Therefore, simply raising the visibility of timebank interactions and their frequency could strengthen members' perceptions of trustworthiness. Building on increasing the visibility of interactions, rider participants lamented their inability to develop relationships with drivers when using real-time ridesharing applications. Their concern suggests that providing a way to ask for specific drivers, particularly on a repeat basis, could be desirable. Providing such requests could allow riders and drivers to form closer relationships while also building a basis for trust in "performance"; that is, "actual deeds, present conduct, currently-obtained results" [55, p.77]. Furthermore, once riders and drivers were able to interact through events or successful transportation transactions, they might benefit from ways to pair with or suggest their driver *or* rider. In terms of promoting trust within a timebank context, a ride characterized by lack of safety or reliability would risk damaging a person's reputation within a closed network such as the timebank. Furthermore, as findings showed, an intermediary could hold a driver/rider accountable for bad experiences. Application features such as requesting the same driver over time or automatically connecting based on feedback are worth future investigation.

Conversely, histories of exchange were not salient among non-timebank members, most of whom were associated with the FQHC. Their shared common identity was the association with a healthcare organization at which they received healthcare services. A person's condition (e.g., older, physical disability) comes with a level of vulnerability and heightened concern for physical safety, a factor that was evident in our study results. Thus, non-timebank entities might consider ways to make it easier to "test the waters" and interact (e.g., online vetting events or adding friend features to enable video or phone chatting) before a ride. Thus, shared mobility systems in the context of a timebank must provide opportunities for vetting through social interactions and, as we discuss next, offer more transparency through certifications and seals of approval.

7.1.2 Driver Certifications and Seals of Approval. Recall from our findings that participants felt that a proper role for intermediaries was to verify or provide certifications. FQHC participants requested official vetting of potential drivers from the FQHC, as did timebank members. Both timebank and FQHC participants wanted proof of relevant credentials (e.g., driver's license, vehicle registration, proof of insurance, background checks) to feel comfortable sharing rides with a potential driver. Figure 2a indicates a successful background check, proof of licensure and vehicle registration, and suggestions for other endorsements to assess in the future. The screen also includes the number of offers and requests that Bob had made in the timebank, another indicator of past timebank activity. Besides traditional five-point reputation systems standard in applications like Lyft and Uber, we recommend driver certifications and seals of approval from intermediaries. Such certification could either show that relevant credentials had been verified or develop novel certifications to represent their records with the timebank or healthcare center providing rides. Specifically, intermediaries could give a certificate, likely through tracking logs and hours, to show the number of miles a driver had driven and other ways to indicate their driving skill and safety, or their record of providing reliable service (i.e., rating, reviews). Figure 2b shows an example of what a certificate could look like. "Official" vetting from an intermediary could also consist of proof that drivers completed some form of training (as desired) and that they had completed a written checklist to prepare a vehicle for a ride or followed COVID-19 safety protocols. Figure 2 is a mockup of how this might be implemented in a corresponding digital application. Future ridesharing technologies focused on equitable transportation to healthcare appointments should consider integrating into existing community timebanks and nonprofit healthcare providers like FQHCs to implement our findings.

7.2 Promoting Relational over Transactional Interactions

Building on the above, we argue that timebank-mediated transportation platforms should draw on network theory and incorporate design techniques to provide opportunities for potential drivers and riders to interact and form relationships. These interactions would thus build observations and memories and make a person's history and tenure in the timebank more salient as a method of supporting appraisals of the reputations of others. Historical traces should include the number of timebank exchanges, hours logged, and endorsements (e.g., reviews, references, ratings) received from others in the timebank. Because our findings advocate relational over transactional interactions, we offer recommendations for endorsement via badge exchanges with these results. We recommend designs that allow both riders and drivers to give each other feedback. As shown in Figure 3, we also recommend more relational exchanges such as fist bumps and virtual hugs to represent the importance of gratitude that participants stressed in sessions. We also recommend opportunities for riders to specify additional requirements like the need for a wheelchair or car seat (Figure 3b). Indications of "on-time" or "safe" arrivals could also address reliability, safety, and

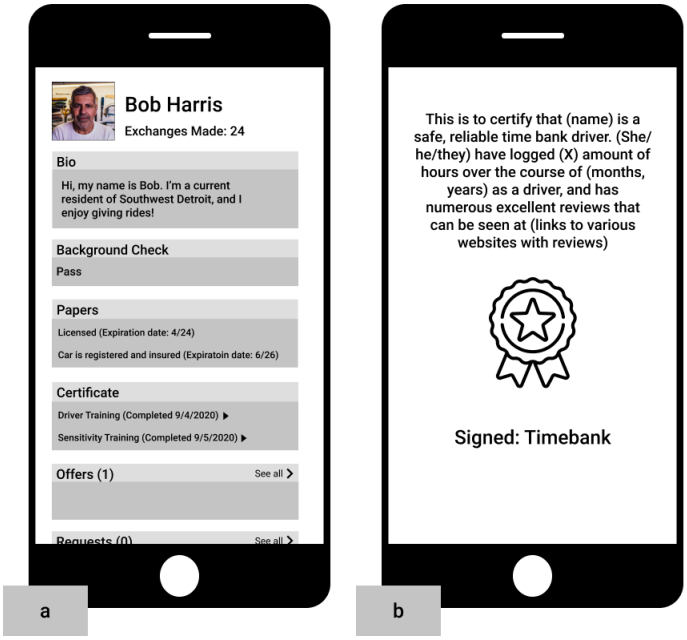

Figure 2: Design suggestions for certification (Figure a (left) draws from sociological trust theory [55] to allow for secondhand cues from individual credentials such as background checks and certificates to foster trust. Figure b (right) shows a certification from the timebank, which draws from the "carryover effects" of institutional trust [55]. Both are examples of designs that aim to foster trust by demonstrating a history of reciprocal exchanges [7].)

accountability concerns (Figure 3c). Other suggestions to mitigate safety-related concerns include indicating whether conversations were "enjoyable" or that the ride was "peaceful."

7.3 Balancing Reciprocity

Our findings suggest methods to balance reciprocity. On the one hand, all timebank hours are equal, and some participants felt firm in these principles. On the other hand, rides used gas and led to vehicle wear and tear that could not be fully accounted for with time dollars. Thus, many participants suggested that the timebank should help manage their vehicle wear and tear costs and maintain a library of equipment that might accommodate a ride like car seats. Drivers who drove a certain number of miles or hours could request reimbursement for wear and tear. Technology could be used to both book equipment and identify drivers whose level of transportation service provision warranted compensation beyond time dollars.

Furthermore, to expand the availability of healthcare transportation, systems could build on opportunities for reciprocal exchange beyond monetary transactions, such as the ones presented in Table 3. Past research suggests that some people are unclear about what they could offer. Systems could thus encourage timebank members to offer exchanges that they had not previously considered and could be a start to addressing long-established timebank challenges. For instance, the table shows that beyond providing transportation, participants could do yard work for someone, cook, or grocery shop, which today could be done online. These interactions could better support transportation managed by intermediaries like the timebank and provide further opportunities to balance reciprocity.

In addition, healthcare transportation is perhaps particularly vulnerable to atypical needs, such as stepstools, baby car seats, or additional stops to pharmacies after health care appointments. Accordingly, participants agreed that early interactions through the timebank should facilitate alignment of expectations in advance of a ride. Currently, some participants may hold video or phone calls to negotiate the terms of an exchange. Extending this, participants described several potentially awkward issues that they would like ride booking systems to address in advance. Systems could be designed to surface any requests for gas money or other expenses (e.g., parking) so that potential riders could use this information to select drivers. Advance information could let drivers know how many people would be in the vehicle and whether any required additional equipment such as a baby stroller or agreements to wear masks to protect against COVID-19.

8 STUDY LIMITATIONS AND FUTURE WORK

The following study limitations should be kept in mind. This study took place in a single geographical region with members of a specific timebank within the area. Timebanks operated in different regions, and cultures may behave differently as intermediaries in different areas (e.g., timebanks affiliated with churches or other nonprofits may follow different norms and conventions) [50]. We also recruited from a single FQHC. The majority of our participants were women, and participants included older adults and disabled people

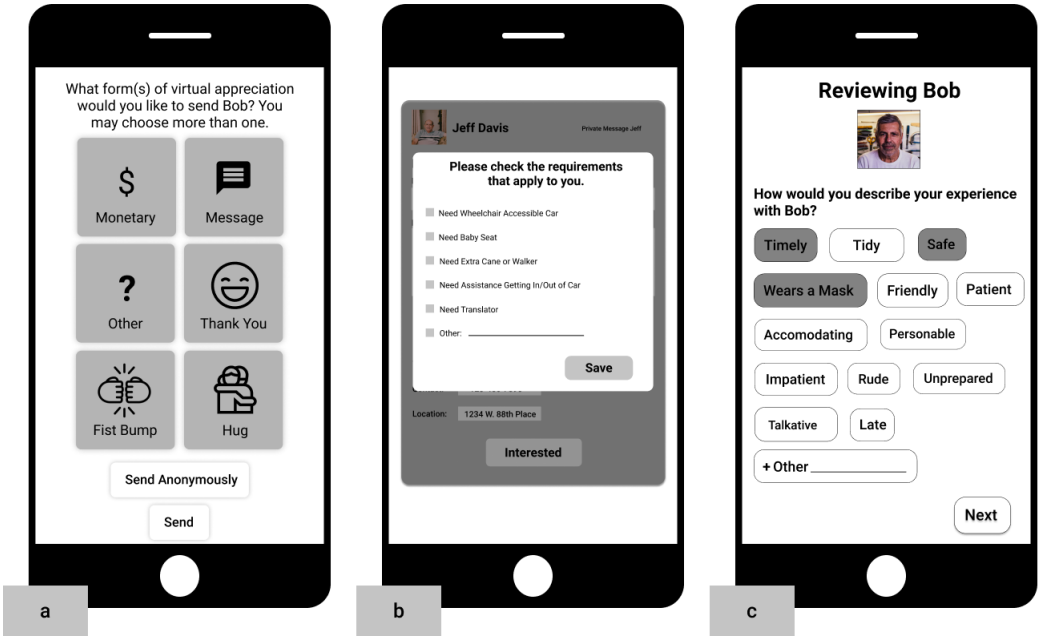

Figure 3: Design suggestion for relational transactions and indications of safety and reliability

in the sessions. Safety-related concerns might be more prominent among these demographic groups than others [64]. Further, while the timebank with which we partnered skewed toward older adults, less than half of our participants were ages 50 and over. Our shift to an online-only method due to COVID-19 restrictions might have been less appealing to older adults than face-to-face workshops would have been. Further, because our results do not reflect participant experiences giving and receiving rides during the COVID-19 pandemic, COVID-19 responses are primarily hypothetical. Further research would need to be conducted in the future to understand details about the safety-related cautions raised in our work. Nevertheless, we are confident that our main findings as they relate to trust and reciprocity generalize in this context.

Finally, we have not assessed our recommendations with participants nor in depth with the timebank and the FQHC, and practical issues in their implementation may emerge. For instance, the Internal Revenue Service could tax any exchanges if monetary value was assigned to hours [9]. We plan to assess our proposed recommendations and examine acceptability and feasibility with them in the future.

9 CONCLUSION

We drew insights from a set of online workshop sessions with drivers and riders from Detroit to understand how to design shared mobility systems for healthcare, and in the context of a timebank. We drew from network closure and trust literature to contribute considerations for how intermediaries might facilitate safety, reliability, and reciprocity. We contribute a set of concrete design insights that build upon this knowledge and suggest promoting relational interactions over transactional ones. Future research should investigate whether our recommendations are acceptable and feasible for intermediaries in addition to drivers and riders (see Table 4).

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10 APPENDICES

A ACTIVITY PACKET DETAILS

As stated in the main text, participants registered via a "registration" link, which contained a survey and consent form. The survey asked participants to provide their participant ID, which their packets included. They also provided information about how they heard about the timebank, a set of demographic questions that asked for their race/ethnicity, level of education, their birth date, zip code, and information about their access to technology. The survey contained a set of questions to confirm participant eligibility (i.e., that they lived in Detroit had either had trouble getting transportation to a healthcare appointment or given someone else a ride to a healthcare appointment).

The consent form contained the purpose of the study[2], information about what would be required of their participation, compensation details (which was a $50 gift card for full completion or a $10 gift card for partial completion), and the research team's contact information. The consent form encouraged participants to reach out to the team for more information about the study, any questions, or express any concerns. Inspired by past work extending participatory design methods to remote and virtual settings [25], we printed and distributed our packets to our community partners so that workshop attendees could pre-fill the forms before each session. We also did this, which worked well due to the socially-distancing restrictions of our university.

We similarly constructed the rider and driver packets. The rider packet was several pages longer than the driver packet. Whereas the rider packet consisted of 21 pages in total, the driver packet consisted of 17 pages. The first page of each packet contained a unique participant ID. The second page consisted of a participant checklist to confirm that all participants had completed the online survey, provided their participant ID on the top right of all pages, and read the packet instructions. The checklist consisted of a step for participants to take pictures of their exercises with their phone camera or other device and where to share these photos (i.e., text or Whatsapp, email as attachment, and a link to upload the pictures). The checklist also provided the zoom link to the session (session dates and times were provided via email) and contact information for questions.

The third page included the purpose of the study, a description of participatory design, and the definition of timebanks for participants unfamiliar with the term. We included a list of "Things you should know" on pages 4-5, including a scenario of a timebank for participants who were unfamiliar with how timebanks worked and a set of instructions for completing the packet. Pages 6-20 of the rider packet (see Figure 4). and pages 6-16 of the driver packet (see Figure 1) included participant exercises to complete. The exercises consisted of questions embedded in a storyboard designed with colored cartoon-like images and short bodies of texts that described and narrated hypothetical scenarios of characters depicted as drivers and riders (see Figures 1 and 4). We designed the scripts and questions of the storyboards to elicit written responses from participants to help address our research questions and further inform the questions and prompts for the follow-up online focus groups.

The packet for riders depicted 'Rosalyn' (the rider), a 55-year-old woman who needs a ride to get to her healthcare appointments (see Figure 5). Questions in this packet covered aspects related to trust, safety, compensation, and rating of drivers when getting a ride from a stranger. The packet for drivers depicted 'Joe' (the driver), a man in his 50's, who uses a timebank app to provide rides to healthcare appointments Questions in this packet covered information about the appointment, trust, compensation, making accommodations for riders, and driving someone else's car for the ride. Finally, both packets depicted the character 'Tom' (the potential driver), a 60-year-old man, who decides to use the timebank to provide rides to people Questions in this scenario asked participants about trust and safety concerns regarding getting a ride from a stranger. They were also asked to list possible transportation solutions for riders and describe services that they could offer or need from a timebank-based app.

The final page of the packets thanked participants and instructed them to return to the checklist on the first page, which included the remaining instructions to take pictures of the completed exercise pages and where to send this information.

[2]The consent form stated that "The purpose of this study is to learn about how people currently navigate transportation barriers to attend healthcare appointments and to generate ideas for how a service to better meet their needs. Results from this project will help us develop a new transportation service that can assist people in attending healthcare appointments as needed."

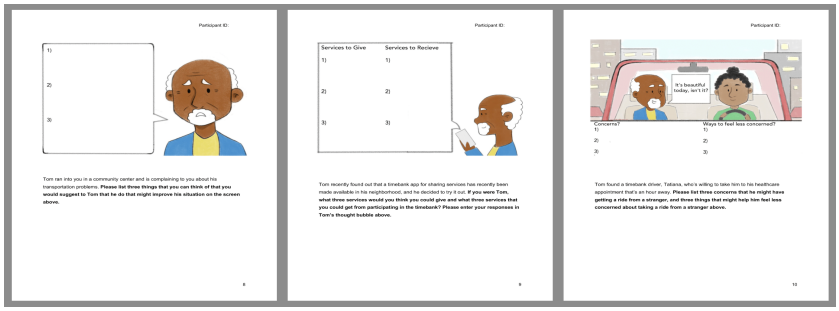

Figure 4: Select pages from the "Rider", or passenger activity packets that were delivered in advance to passengers (e.g., "Tom"). This packet helped to guide participants through the online design sessions.

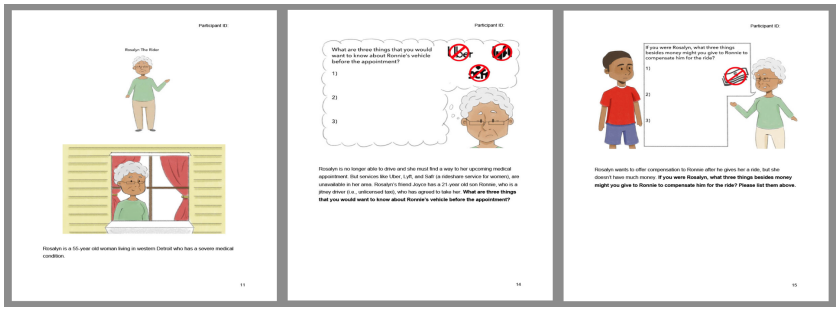

Figure 5: Select pages of "Rosalyn the Rider" activity packet that was delivered in advance to drivers. This packet helped to guide participants through the online sessions.