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A Mobile Health Tool for Peer Support of Individuals Reentering Communities After Incarceration

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Abstract: Individuals just released from prison, or returning citizens (RCs), face high mortality rates during the reentry period, with cardiovascular disease (CVD) being a leading cause. Peer mentors can support RCs' health, but they traditionally work in person, which may not always be feasible, particularly during pandemic outbreaks such as COVID-19. We used human-centered design to build a prototype of RCPeer, a web/mobile application (app) to support peer-led reentry efforts through CVD risk screening, action planning, linkage to resources addressing reintegration needs (e.g., housing, transportation), and goal-setting. We assessed feasibility, acceptability, and usability of RCPeer using mixed-methods. System Usability Scale (SUS) scores were 68 for peers and 66 for RCs, indicating good usability. Qualitative data suggests that RCPeer can support reentry tasks through RCs and peers sharing data, strengthen RC-peer relationships, and facilitate RCs meeting their goals. Future work is needed to enhance usability for RCs with limited technology experience.

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The first 90 days immediately following release from prison is a challenging period during which immediate basic needs such as housing, employment, and transportation are often prioritized over management of chronic health conditions. Returning citizens' (RC) health may be further affected by the stress of addressing the onslaught of reentry needs (e.g., housing, work, legal needs). Returning citizens face risk of death 12.7 times greater than the general population in the first two weeks following release from prison, with cardiovascular disease (CVD) being one of the leading causes.¹⁻³

U.S. military veterans reintegrating into the community after incarceration face a high risk of CVD. Veterans, who constitute 8% of state and federal prisoners, are at even greater risk of CVD than non-veterans irrespective of socioeconomic characteristics, chronic conditions, health behaviors, body mass index (BMI) and depressive symptoms.⁴ While proportionately, the number of veteran inmates is declining, the number of older imprisoned veterans continues to increase, contributing to a greater risk of morbidity and mortality, hospitalization, and homelessness upon release.^{3–8}

Peer-assisted approaches are vital to fulfilling and prioritizing unmet needs of vulnerable and marginalized populations.9,10 Peer specialists, used widely in mental health and substance use settings, are individuals who are in recovery themselves, but are substantially further along in their recovery journey than those they assist.¹¹⁻¹³ They provide mentoring, problem-solving, social support, and a sense of hope to the individual who is struggling to attain better health and emotional well-being. Peer programs have yielded improvements in housing retention for the chronically homeless,^{14,15} veteranfocused programs have demonstrated positive effects of peers in promoting linkage and engagement in health care and related services.^{16,17} There is a growing awareness of the role that peers can play in criminal justice settings, increasing access to care and reducing health disparities between RCs and individuals who do not have incarceration experience. A randomized clinical trial, for example, showed the effectiveness of peers in contributing to viral suppression for RCs with HIV.¹⁸ Studies show that peers who themselves have incarceration experience are more likely to be trusted by RCs compared with other health professionals such as social workers and psychologists.¹⁵ Furthermore, shifting the task of primary screening for CVD from physicians and nurses to workers such as peers can be more cost-effective and efficient in addressing CVD risk factors.¹⁹⁻²¹

Mobile health (mHealth) technology has the potential to vastly improve the effectiveness of peer-based care delivery to RCs during the critical period immediately following release from prison. The capabilities of mHealth technologies to securely handle sensitive data present an opportunity to support collaborative relationships between RCs and peers during the reentry period. Mobile tools to facilitate the work of peers with populations other than RCs have been found to be both feasible and acceptable.^{22,23} mHealth can alleviate the cognitive burden for the peer through automated calculations of CVD risk scores and providing a platform for peer coaching. While there are hundreds of web- and mobile-based innovations supporting CVD care, very few are evidence-based and, to our knowledge, none have been designed to reduce the health disparities for RCs reentering the community.^{24–26}

The peer's role is critical during reentry; they assist RCs with access to health care, housing, transportation, and employment needs that can help promote RCs' self-efficacy and eventual independence. Peer interactions with RCs can be used to empower them through supportive, normalizing messages, suggesting that, while tasks may seem overwhelming, supports exist. mHealth can help streamline peer workflow and communication with RCs in two essential ways—by providing a platform to more easily engage in collaborative action planning and completion of tasks, and by enabling non-clinically trained peers to safely assess CVD risks, which can greatly mitigate CVD risk factors. This dual approach addresses the RC's perceived pressing needs while raising awareness of CVD health risks, creating a safe and open opportunity for continued conversations and personalized actions to address CVD.^{1,27-29}

In this study, we designed and developed the prototype of a novel web/mobile application (app), RCPeer. This app can help identify and address elevated cardiovascular disease risk among RCs, through CVD screening and action planning; more broadly, RCPeer can assist RCs in navigating the many health, emotional, and subsistence (e.g., housing, income) challenges faced during the reentry period. The app was designed to address a gap in tools supporting cardiovascular health of RCs and support peers working with RCs remotely. It was modeled after a largely in-person peer support program, the Post-Incarceration Engagement (PIE) project, that employs certified peers who are veterans, often with incarceration experience themselves, serving veteran RCs.^{9,30} While developed with direct inputs from veterans and peers employed by the U.S. Department of Veteran Affairs (VA), feedback was also collected from non-veterans to ensure the generalizability of RCPeer to serve veteran and non-veteran RCs alike, and the peers working with them.

Methods

Study design. We used a human-centered design (HCD) approach to build and test a prototype of RCPeer. A sample of potential target end users (peers and RCs) were recruited from two different sites to participate in qualitative interviews with the following aims: 1) to generate a user-informed assessment of key traits of the prototype, 2) to validate the app design, and 3) to test the usability of the prototype in controlled settings. Interviews with target end users in Aim 1 were conducted in June to August 2019. Aim 2 interviews were conducted from August to December 2019, and Aim 3 interviews were conducted January to February 2020. We engaged peers and RCs at various points throughout the design process to ensure that the app was responsive to user needs and feedback and prepared for eventual adoption and uptake. We used a mixed methods approach (in-depth, semi-structured interviews and quantitative surveys) to address our primary goal of demonstrating usability, acceptability, and feasibility of RCPeer to support peer-led reentry efforts. Feedback collected from each aim was rapidly analyzed and iteratively incorporated into updates to the prototype.

Study settings and population. Participants were recruited from a suburban multiservice campus and an urban, city-run office dedicated to returning citizens. To be eligible, peers had to be 18 years of age or older and actively working with RCs at time of recruitment. A peer was defined here as a frontline worker working directly with RCs to support reentry needs such as peer specialist, recovery coach, or support specialist. Returning citizens had to be 18 years of age or older and released from incarceration within the previous 12 months to be eligible to participate. A purposive sample of peers and RCs was recruited using a method of snowball referral led by study team members at respective sites based on the aforementioned eligibility criteria. All study activities were reviewed and approved by the New England Institutional Review Board (IRB) and the research study site's IRB.

Data collection and analysis. There were three rounds of interviews, corresponding to each study aim—the first to generate a user-informed assessment of key aspects of the prototype, the second to validate the app design, and the third to test the usability of the prototype in controlled settings.

In the first round of interviews, RCs and peers participated in in-depth, semistructured interviews with a master's level anthropologist. Interviews were one hour in duration. Open-ended probes for RCs included the following: *Are there goals or things you would like to accomplish with your peer or the person who helps you with your health care needs? How do you (or would you) communicate with or get assistance for appointments from your peer?* Probes for peers included the following: *How do you currently communicate with RCs? Which parts of your peer support job could be enhanced by a mobile app?* Interviews were audio-recorded with the participant's consent and transcribed. Co-authors thematically coded the qualitative data and identified common themes that were then discussed with subject matter experts on the team to validate the design of the prototype. Syntheses covered key needs of the RC and peer, as well as specific CVD-related topic areas to include in the prototype.

We conducted a second round of interviews to verify the first prototype design with re-recruited and newly recruited RCs and peers. Candidates for these interviews were eligible to participate if they met eligibility requirements described above. Peers and RCs participated in in-person, one-hour, one-on-one sessions in which an RC- or peer-facing prototype interface was verified using a guided walkthrough method.³¹ The walkthrough was followed by open-ended questions to solicit additional qualitative feedback. Participants were asked for their input into the design of the prototype and specific features such as peer profiles and a list of external resources were added in response to requests from participants.

Peers and RCs participated in a third round of interviews including usability testing. Individualized usability testing sessions were conducted to verify the prototype design. Again, returning citizens and peers participated in one-hour, in-person, one-on-one interview sessions. The session consisted of two parts: a) a task-based usability test and b) a semi-structured interview. The participant used the functional prototype of RCPeer housed on a study tablet to perform pre-defined hypothetical role-appropriate task scenarios with minimal instructions. A concurrent think-aloud protocol was used to understand what each user was thinking as s/he interacted with the working prototype of RCPeer. All sessions were audio- and screen-recorded with participants' consent. Audio recordings were professionally transcribed. De-identified transcripts and screen recordings were analyzed by the study evaluation team. All participants

SU	S Item	1	2	3	4	5
1 2	I think that I would like to use this system frequently. I found the system to be simple.					
3	I thought the system was easy to use. I think that I could use the system without the support of a					
4	technical person.					
5	I found the various functions in this system were well integrated.					
6	I thought there was a lot of consistency in this system.					
7	I would imagine that most people would learn to use this system very quickly.					
8	I found the system very intuitive.					
9	I felt very confident using the system.					
10	I could use the system without having to learn anything new.					

Figure 1. 10 positive SUS assessment items rated on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree).^a

Note:

^aThe SUS is a widely used tool to assess the usability of new technologies.

SUS= System Usability Scale

were asked to complete the 10-item Likert-scaled positive SUS, a widely used questionnaire to assess users' perceptions of the usability of new technologies, which has been validated for use with mobile and web apps.³² The SUS was administered at the end of the testing session and open-ended questions were asked to gather overall impressions of the user's experience (see Figure 1). System Usability Scale scores were summarized with descriptive statistics and qualitative feedback were coded with recommendations for improvement. The scale is scored by summing participants' scores for each item re-scaled as a score from 0 to 100 with higher total scores on the scale indicate higher perceived usability.³³

All walkthrough and usability testing sessions in the second and third aims described above were conducted by an experienced usability specialist and a trained research assistant (RA). All sessions were audio-recorded with participants' consent. De-identified transcripts were analyzed by the RA using the same qualitative methods described in Aim 1.

Prototype design. The RCPeer prototype was built on CommCare, which is an existing robust, open source, HIPAA-compliant platform. CommCare has been widely adopted and used primarily in low-resource settings by frontline workers around the world and is optimized for use as a native app on Android device or web app.³⁴ The CVD screening tool included in the prototype additionally requires the use of a digital blood pressure cuff, measuring tape, and scale to determine the RC participants' body mass index (BMI), an input needed to calculate the CVD risk score.

The final prototype was designed iteratively with feedback collected from potential target end users in two rounds of interviews, and usability-tested in a third round of interviews (see Figure 2 for example screenshots). Separate interfaces were developed for and tested with peers and RC, respectively. The seven core functionalities of RCPeer were first identified based on feedback collected in the first round of interviews and developed and refined further after the second round of interviews. Paper-based sur-

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Profile Tools and Surveys	Tools and Surveys Personal Health Inventory (PHI) My Priorities Heart Health Screening	Create RC Profile Work with an RC	Work with an RC Update RC Profile Personal Health Inventory (PHI) Wy Priorities Health Screening
My Actions	N HOULDS	Peer Profile	 Resources Create an action Review actions

Figure 2. Screenshots of the RCPeer prototype.^a *Note*

^aRC main menu (far left) and an example RC sub-menu (left) and peer main menu (right) and example peer sub-menu (far right).

veys currently used by a Veterans Affairs (VA)-based peer program were adapted for the app. These surveys, My Priorities and Personal Health Inventory, were developed by VA affiliates for use by veterans.³⁵ The surveys are widely used as part of the Whole Health Initiative at VA medical centers and consist of questions about the level of perceived priority of a variety of health and lifestyle topics, such as housing environment and access to medical care, with Likert-scale responses. The prototype was also designed to include an action plan module that consists of a personalized, dynamic action plan developed jointly by the peer and RC. The action plan can be updated by the RC to indicate completion of tasks. The interactive module allows for joint peer and RC review of the RC's progress over time. Subject matter experts on the study team advised the research team in building a list of suggested tasks to support health goals. A non-laboratory-based CVD risk assessment tool that has been validated with community health workers working in low-resource settings was incorporated for use by peers and RCs to assess RCs' CVD risk level.^{20,21} The CVD risk assessment tool also requires use of a blood pressure cuff, scale, and measuring tape to calculate the BMIs of the RC participants. Comfort with and use of these tools were also assessed in usability testing as part of the task of CVD risk screening.

Specific updates to the prototype that were implemented following the second round of interviews included the following: 1) making certain profile registration questions optional that might be considered sensitive information, such as time spent in prison; 2) creation of a brief profile for peers that includes name and phone number; 3) modified message to patients communicating CVD risk level and information; and 4) use of patient-friendly language (e.g., "heart health" rather than "cardiovascular health").

Results

Table 1 shows the demographic profile of the RCs and peers, indicating which round (or rounds) of interviews they participated in. Eight RCs participated in the first round

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Table 1.

PARTICIPANT DEMOGRAPHICS^a

	In	tervie kound	Ma I				Demographics			
Participant	1	5	3	Age	Race	Gender	Education (Highest degree attained)	Tech savviness (out of 10)	Phone type	Hours per day on phone
Peers										
Pl	Х	Х	Х	45-54	White	Female	Master's	6	iPhone	10-12
P6	Х	Х	Х	45 - 54	White	Male	Associate	Ŋ	iPhone	0^{-3}
P17	Х	Х	Х	45 - 54	White	Male	Bachelor's	10	iPhone	0^{-3}
P2	Х			45 - 54	White	Female	Bachelor's	IJ	iPhone	7–9
P3	Х			45 - 54	White	Female	Some college credit, no degree	7	iPhone	4-6
P4	Х			25 - 34	White	Female	Master's	8	iPhone	0^{-3}
P5	Х			45-54	I do not wish to share	Male	High school graduate/diploma or the equivalent (GED)	ŝ	iPhone	0-3
P11		X		55+	White	Male	Bachelor's	7	iPhone	4-6
P20			Х	55+	White	Male	Bachelor's	7	iPhone	4-6
P21			X	55+	Black or African American	Male	Some college credit, no degree	Ŋ	Android	4-6
RC										
R1	Х			45-54	Hisp. or Latino, multiracial	Female	Master's	9	Android	7–9
R2	Х			55+	Black or African American	Male	High school graduate, diploma or the equivalent (GED)	7	Android	4-6
R3	×			35-44	Black or African American	Male	High school graduate, diploma or the equivalent (GED)	ĉ	Android	4-6

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	In	tervio Rouno	ew L				Demographics			
Participant	1	2	3	Age	Race	Gender	Education (Highest degree attained)	Tech savviness (out of 10)	Phone type	Hours per day on phone
R4	X			45-54	Black or African American	Male	High school graduate, diploma or the equivalent (GED)	1	Android	0–3
R6	Х			55+	Black or African American	Male	High school graduate, diploma or the equivalent (GFD)	œ	Android	0-3
R7	Х			45-54	Black or African American	Male	Trade/technical/vocational training and Associate Degree	Ŋ	Android	0-3
R8	Х			55+	White	Male	High school graduate, diploma or the equivalent (GED)	I	Other	0–3
R9	Х			55+	White	Male	High school graduate, diploma or the equivalent (GED)	1	Android	0–3
R11		Х	Х	55+	Other	Male	Bachelor's degree	×	Android	0^{-3}
R12		Х	Х	35-44	White	Male	Bachelor's degree	6	Android	4-6
R13		Х	Х	45-54	Other	Male	Associate degree	7	Android	4-6
R18			Х	55+	White, Native American or American Indian	Male	Trade/technical/vocational training	1	Android	0-3
R20			X	45-54	Black or African American	Male	High school graduate, diploma or the equivalent (GED)	1	Android	0–3
Note:			1							

*RC participants included: 5 non-veteran RCs and 8 veteran RCs. Peer participants included: 3 non-VA and 7 VA peers.

of interviews, five in the second, and five in the third round. Seven peers participated in the first round, five in the second round (two newly recruited and two re-recruited from the first interviews), and five in the third round (four re-recruited from previous interviews and one newly recruited). Of the 13 RCs interviewed, the majority were male (92.3%), non-White (71.4%), and over the age of 45 years (78.5%), and all had at least completed high school. All RC participants reported owning a smartphone and the majority reported spending three hours or less per day on their phone (57.1%). When asked to rate their own tech savviness on a scale of 1 to 10 (in increasing savviness), RCs reported an average level of 4.5 (SD=2.91). Eight RCs were veterans, and five RCs were non-veterans. Of all 10 peers interviewed, four were female (40%), 60% were 45 to 54 years of age, and 80% were White. A total of 90% reported education beyond high school. All peer participants reported owning a smartphone and the majority reported spending six hours or less per day on their phone. Peers' average self-reported tech savviness was 6.3 out of 10 (SD \pm 1.95), with 10 indicating highest perceived tech savviness.

Usability metrics and user feedback. In general, the RCPeer prototype was perceived by potential target end users, peers and RCs, as usable and having utility. While not all participants completed all tasks in the usability task list, SUS scores were collected based on users' overall experience using the app to perform these tasks. Mean SUS scores for peers and RCs were 68 and 66, respectively, with a majority (70%) of individual SUS scores exceeding the industry average of 68.³² (See Table 2.)

In general, both peers and RCs reported RCPeer as being potentially useful in supporting multiple day-to-day aspects of reentry efforts based on its ability to allow RCs and their care team to share and sync data on a single platform accessible from a computer or mobile device. Main qualitative themes and suggested improvements collected from peers and RC feedback are described in detail below with supporting quotations from peers (indicated with participant ID prefixed with "P") and RCs (prefixed with "R").

Challenges faced in reentry. Returning citizens and peers stated that mental health, substance use, employment, and housing are top priorities in the time period following release from incarceration. Specific challenges reported in these areas include finding appropriate counseling or support, identifying jobs that are open to individuals with incarceration experience, and accessing stable, affordable housing. Some RCs stated that it is challenging to balance their parole requirements with a job and that having their parole officer check in at work or needing to attend meetings during the workday is difficult. Additionally, peers discussed the need for some RCs to live in sober or recovery-focused housing but noted that sometimes recovery houses exclude people with certain convictions. While addressing mental health is regarded as a high priority, physical health is not perceived as a top priority or concern. One RC stated, "Unless you already have preexisting issues, it's like low on the totem pole of [priorities] like, 'I need a place to stay, then I'll worry about my teeth.'" (R12) Peers repeatedly referred to Maslow's Hierarchy of Human Needs³⁶ when discussing the action planning and survey portion of the app, suggesting the relevance of this motivational theory as an underlying driver for addressing the most basic needs first.

Barriers to use of RCPeer. Several RCs and peers cited their own lack of comfort with sharing or requesting medical information as a barrier to use of RCPeer. It was

Table 2.

					SUS	Item					
Participant	1	2	3	4	5	6	7	8	9	10	Score
Peers											
P16	2	2	1	1	2	3	1	3	2	2	45
P17	4	3	3	3	3	3	4	3	3	3	77.5
P18	4	3	3	3	3	2	3	2	0	2	60
P20	4	3	3	4	3	4	3	3	3	3	80
P21	4	3	3	3	4	4	4	3	3	4	75
			Av	erage	Peer	Score	e: 70 (Medi	an= '	78, SE) =16.6)
RCs											
R16	3	3	3	3	3	3	2	3	3	3	72.5
R17	2	1	0	1	1	2	0	0	0	1	20
R18	4	2	2	1	3	3	4	4	3	1	67.5
R19	3	2	4	3	2	4	4	3	4	2	77.5
R20	4	4	3	4	3	3	4	3	4	4	90
			A	verag	e RC	Score	e: 66 (Medi	an= '	73, SE)=26.8)

SUS SCORES^a

Note:

^aRaw values displayed for each item. Scores were calculated in two stages. First, subtract one from each item. Second, add up the scaled items and multiply by 2.5 (to convert the range of possible values from 0 to 100 instead of from 0 to 40). SUS = System Usability Scale

observed that the relationship between peer and RC is non-clinical and, in several cases, peers did not feel comfortable using the CVD screening tool or providing clinical information related to CVD. Peers said that they were, however, willing to support RCs with health-related tasks by doing things such as reminding them to schedule appointments, offering rides, or assisting RCs in connecting to a health care provider.

The CVD screening tool included in the app was perceived as less useful by those participants who had known, preexisting CVD or risk factors such as high blood pressure, diabetes, and CVD. These conditions were reported by many RC participants, and peers noted that the conditions are common among the RCs they work with. When asked for an estimate of how many of their clients had high blood pressure, one peer responded, "It would be quite a few. And that would increase the longer they're out of the jail because they might be using substances . . . we see a lot of high blood pressure out there." (P20) Returning citizens stated that the app did not feel relevant to them because they were unable to use the CVD screening tool due to their preexisting condition. While RCs with preexisting conditions perceived the screening tool to be less helpful for them, they were open to the app providing educational information to address their conditions and risk factors (e.g., hypertension, diabetes).

Lack of familiarity with and limited access to mobile devices was the third barrier to use identified in interviews. Some participants commented that their prison term began before cell phones were common. Some remarked that they were familiar with flip phones but learned to use smartphones only after release from prison, leaving them feeling left behind technologically. Additionally, smartphones and data plans can be expensive and difficult to maintain for RCs who may lack employment and/or have low income.

Notably, when participants were asked to report their tech savviness from a scale of 1 to 10, RCs reported an average of 4.5 out of 10 (SD = 2.91) and peers, 6.3 out of 10 (SD = 2.0). In some cases, participants found the app difficult to use. "I'm really overwhelmed with this app.... It just, to me, seems exhausting." (P17) Given the lack of familiarity and perceived savviness with technology reported by both peers and RCs, it will be important to simplify and increase usability of the app in future versions to ensure accessibility to this population.

Usefulness of RCPeer. Participants indicated that RCPeer would be helpful in evaluating and framing a conversation about needs, identifying immediate priorities, and goal-setting. Participants supported the inclusion of action planning, monitoring, and prioritization in the app and provided specific suggestions for ways the features could be enhanced. When asked whether the app functionalities supporting action planning and prioritization would be helpful, one RC responded that the app would give a "head start" to RCs and help them "get some direction" when they "don't know how they're going to go about getting certain things done." (R2) Additionally, the RC stated that the app "opened doors" by "letting you know people out there do care about your wellbeing." (R2)

Specific suggestions for how to improve the action planning portion of the app included making it more visible in the app, categorizing actions based on surveys used in the app, suggesting tasks or actions, and including automated reminders for actions. One RC commented, "This page is very on top of things that we need and we look for, and we don't want it to be hard to get." (R3)

Linkage to resources. Returning citizens and peers emphasized that it would be helpful to support linkage to specific resources available and accessible to the RC community, such as state and federal benefits, housing options, and Supplemental Nutrition Assistance Program (SNAP) benefits. Returning citizens noted that the app should not just spark discussion but provide assistance that enabled them to act:

I mean coming out of prison, you've got no information, No one gives you any information for anything.... And that, I think—we don't know where to go.... I need, actually, help coming up with an action plan. I don't need an app telling me what are you going to do now about your issues? I'm like, 'I don't know.' (R3)

Peers suggested that the more resources that could be included, the better. "I don't know how resource-rich you can make it, but the more you can, it just makes it even more usable and helpful." (P17)

Additionally, several peers pointed out that mental health, specifically anxiety, is a common challenge that RCs face and relevant resources should be included in the app.

Returning citizens said that they would be more likely to use the app if it were more general. "If it says just the health, [and focused mostly on] the heart, I probably wouldn't [use the app]. But if there was the ability to help me get more benefits, I would." (R12)

Facile communication. Participants indicated that the app should include a facile way for RCs to interface with each other as well as their peers over the course of the reentry period. Returning citizens and peers shared in interviews that communication about logistics or concrete actions and personal growth goals were important. Additionally, RCs stated that oftentimes after release from incarceration, people do not have a large pool of people to talk to and seek support from.

All I need right now is somebody that can guide me to good work or sometimes just good conversations about things like this that really matter. A lot of people wouldn't mind coming to talk about these things because they'd be on their mind. And they don't got nobody to talk to. (R3)

Moreover, the app could make peers more accessible and reduce the need for in-person appointments. When asked whether the surveys in the app would be helpful, one RC responded,

Hell, yeah. . . . Yeah. I can go and meet my peer and get my things checked out and taken care of right then. And now you got to wait all day. I would do that probably twice a week [saving me from] going to the hospital [to get information] because I'd be able to know what's going on. I could check an app. (R3)

Both peers and RCs spoke about the value in sharing experiences and communicating with other peers and RCs to facilitate personal development.

When you can share experiences with another individual you can learn from each other.... So I mean, I think sharing ideals and learning how to work a program together will always be helpful. (R2)

Because there's a lot in here for someone to really grow and develop ... I think it's going to be a good way for the people to [use] the app [for] communication and sort of have a conversation. (P17)

Both peers and RCs felt it would be useful for the app to include communication features or other ways for RCs and peers to connect.

Discussion

We designed, developed, and usability-tested a prototype app that enhances communication between RCs and peers who help them with reintegration into communities. Returning citizens experience a higher health burden compared with the general population, with more challenges in accessing health care resources.⁴ Cardiovascular disease is one of the leading causes of death in this population and affects RCs disproportionately compared with the general population.^{4,37-39} The objective of the work described here was to directly address a gap in usable tools to improve health outcomes related to CVD. System Usability Scale scores and qualitative feedback suggest that the app was of average usability. However, we learned from peer and RC feedback that a more holistic approach to helping RCs and peers collaborate on addressing immediate reentry needs as opposed to a targeted approach to address CVD screening and cardiovascular health could render the app more useful and could be more effective in reducing stress and mitigating CVD risk factors in the long run. Participants stated that they prioritized other needs such as housing, employment, and food security above their health in the time immediately after release from incarceration. With this information in mind, researchers decided future versions of the app need not focus on CVD screening and cardiovascular health support. Instead it could better promote both general and cardiovascular health by better supporting the RCs and peers in addressing RCs' basic needs. This could be achieved through collaborative goal setting between RCs and peers such that health can be prioritized without deprioritizing other pressing needs.

Notably, peers indicated hesitation in engaging in a discussion with RCs on issues related to CVD or any other medical information as this was outside the purview of their relationship. They felt that the primary role of the peer is to provide social and emotional support. We found low usability with the blood pressure cuff that was used for the CVD screening tool because the peers were not comfortable or familiar with the tool. Furthermore, peers emphasized the importance of building trust and a relationship with RCs and expressed concern that becoming too clinical would diminish the trust in the relationship. One peer stated, "I'm not a clinician, and it's a bond thing, a trust thing." (P5) In order to address participants' concerns about sharing clinical health information, future versions of the app could be expanded to include additional user roles for clinically trained workers to assist with CVD screening. The app could also include a privacy and security statement that users could view when they set up their profile.

The CVD screening tool's parameters make it non-applicable to individuals who have specific preexisting conditions, including high blood pressure. As noted in the results, several study participants had diagnosed hypertension. The app could be improved by including more information about the eligibility criteria for the CVD screening tool or by including a more nuanced risk assessment that could accommodate some of the common preexisting conditions present in this population.

One key barrier to use among RCs was lack of access to phones with a data plan. While the prototype described here was usability-tested as a native mobile app on an Android smartphone, the app can be accessed as a web app and is thus platform-agnostic, increasing its accessibility for peers and RCs. These individuals may not have easy access to or own a mobile device, but because of the web app they can still access RCPeer, for example, by logging into the web app at a library or shared computer with Internet access. Furthermore, initiatives have been taken to make smartphones more broadly available to RCs who lack access. For example, through the HPO's CARES Act Veteran Smartphone Initiative, HUD-VASH, a housing voucher program that is a common source of housing for veteran RCs, is providing smartphones with unlimited data plans to veterans who do not currently own a device.⁴⁰

Feedback from interviews conducted with both veterans and non-veterans in the study indicated that the app design could well serve both cohorts. While the surveys

and resources that were provided and tested in the prototype were based on materials used by peers at the VA, non-veteran RCs and peers perceived the materials to be relevant, and the type of reentry support and priorities described in qualitative interviews were largely similar between veterans and non-veterans.

Strengths/limitations. The strengths of this study included the use of the humancentered design (HCD) framework in the prototyping process, focusing on an important and understudied population, and peer involvement inextricably tied into existing support systems. By using HCD, direct inputs were gathered to inform the iteration and development of the prototype to create a tool that is focused on and tailored to the needs of the users. Additionally, the app was designed to integrate with and build upon existing peer support programs while amplifying peers' relationships with RCs.

The limitations of this study include a small sample size, few female participants, and recruitment from one metropolitan area. Future studies and work on this app could be improved by recruiting a larger, more geographically diverse and mixed-gender group of participants.

Conclusion. To help reduce the health equity gap between RCs and the general U.S. population, we designed and developed a prototype of a novel app, RCPeer, to promote cardiovascular health and augment the work of peers working closely with RCs to achieve successful reintegration into their communities. We built and usabilitytested the prototype with direct feedback collected from potential target end users, RCs and peers, and found that RCPeer was perceived to be useful and usable; however, peers expressed a lack of comfort with facilitating medical screening and health risk assessments. Some concerns were raised about the prioritization of cardiovascular care amidst competing priorities during the reentry period. Nonetheless, RCs and peers in general perceived the app to be useful and desired. Tools designed specifically to preserve and enhance the role of the peer and their relationship with the RC, and potentially provide additional support to allow peers and RCs to navigate medical needs that might otherwise be deprioritized, can greatly increase acceptability and utility of the app. Designing a way for the peer-based system to be generalized to the broader RC population and comfortably raise CVD awareness and health management, while also addressing other pressing RC concerns (such as housing, employment), will be an important focus of future work.

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