Scaling Up Equitable Access to Community-Based COVID-19 Testing: Strategies from the RADx-UP Initiative

RADXUP

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ACKNOWLEDGMENTS

The authors thank Krista Perreira, PhD and Al Richmond, MSW as well as other members of the leadership team of the RADx-UP Coordination and Data Collection Center (CDCC) led by the Duke Clinical Research Institute (DCRI) and the UNC Center for Health Equity Research (CHER) for their thought leadership and guidance during the development of the paper. We also thank the following colleagues at DCRI, Duke-Margolis Center for Health Policy, and UNC CHER for their review: Crystal Cannon, MA, Jonathan Gonzalez-Smith, MPAff, Katie Huber, MPH, Alexandria James, MPM, MSRT, Renee Leverty, MA, Mark McClellan, PhD, MD, Christina Silcox, PhD, and Monica Taylor, PhD, MPH, and Magdalene Wellman, MPH, CHES. In addition, we are grateful to the contributors who provided informational interviews and reviewed draft case studies for this publication, and all the RADx-UP projects and community partners for their work to make testing more equitable. Lastly, we thank the National Institutes of Health (NIH) for their generous support for work on COVID-19 and equity, including this publication. The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official views of the NIH.

We also thank all of the RADx-UP project teams who reviewed and approved content for this report: Vincent Guilamo-Ramos, PhD, MPH, LCSW, RN, ANP-BC, PMHNP-BC, AAHIVS, FAAN with Duke University School of Nursing and Holly Hagan, PhD, MPH with New York University School of Global Public Health (Project 4); Mary Beth Weber, PhD, MPH with Emory University (Project 5); Sohail Khan MBBS, MPH, CIP with Cherokee Nation (Project 17); Marianna Baum, PhD with Florida International University (Project 18); Juell Homco, PhD, MPH with University of Oklahoma School of Community Medicine and Timothy VanWagoner, PhD with Oklahoma Clinical and Translational Science Institute (Project 22); Sally Hodder, MD with West Virginia Clinical and Translational Science Institute (Project 23); Shannon Bentley, MS with Arizona State University and Flavio Marsiglia, PhD, MSW with Arizona State University (Project 25); John Meurer, MD, MBA with Medical College of Wisconsin (Project 33); Mario Castro, MD, MPH and Edward Ellerbeck, MD, MPH with University of Kansas Medical Center (Project 34); David W. Wetter, PhD with University of Utah (Project 35); Rebecca Jackson, MD and Cecilia R. DeGraffinreid, MHS, RHIA with The Ohio State University (Project 36); Ayman Al-Hendy, MD, PhD with University of Chicago and Nahed Ismail MD, PhD, D(ABMM), D(ABMLI) with University of Illinois at Chicago (Project 42); Jannette Berkley-Patton, PhD with University of Missouri—Kansas City (Project 44); Lori Bateman, PhD, MA, Mona Fouad, MD, MPH, and Melissa Ryan, MA with University of Alabama at Birmingham (Project 49); Robert Kirken, PhD and Mancera, Bibiana, PhD, Med with University of Texas at El Paso (Project 51); Ryan Yanagihara, MD, PhD with University of Hawaii at Manoa (Project 55); Antoinette Schoenthaler, EdD FACH with New York University Grossman School of Medicine (Project 63); William M. Southerland, PhD and Karen Parker with Howard University (Project 66); Janice Tsoh, PhD with University of California, San Francisco (Project 68); Guangdi Wang, PhD and Sara Al-Dahir, BSc, PharmD, MPH, PhD(ABD) with Xavier University of Louisiana (Project 69); and Kanecia Zimmerman, MD with ABC Collaborative.

Sarah Bond and Kelly Keefe provided their contributions to this policy paper while at Duke University. Sarah Bond is currently an Associate Consultant at Bain & Company; Kelly Keefe is currently a Senior Project Coordinator at Labcorp.

RECOMMENDED CITATION FORMAT

Thoumi, A., Kaalund, K., Bond, S., Mason, G., Phillips, E., Walker, G. H., Carrillo, G., Keefe, K., Cohen-Wolkowiez, M., Kibbe, W., Corbie, G. (2022). Scaling Up Equitable Access to Community-Based COVID-19 Testing: Strategies from the RADx-UP Initiative. Durham, NC: Duke Clinical Research Institute, Duke-Margolis Center for Health Policy, UNC Center for Health Equity Research.

FUNDING

This study was funded by the NIH RADx® Underserved Populations (RADx-UP) Initiative (U24 MD016258)

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Scaling Up Equitable Access to Community-Based COVID-19 Testing: Strategies from the RADx-UP Initiative

Executive Summary

The COVID-19 pandemic has magnified how structural racism and other structural determinants of health affect the lived experience of the public health emergency on marginalized and minoritized communities. These communities include Black, Latino or Latinx, American Indian, Alaska Native, Asian, and Native Hawaiian and Pacific Islanders communities as well as people who are incarcerated, low-income, or disabled, in addition to older adults, children, LGBTQIA, and birthing people. Achieving an equitable response to COVID-19 and future public health emergencies requires: reducing barriers that preclude populations from reaching health services in a timely manner, centering equity in policy making decisions, and engaging communities. Community-based COVID-19 testing can ensure all populations have access to testing, which is a key step to linking people to treatment and reducing disparities in COVID-19 health outcomes.

Insights from the Rapid Acceleration of Diagnostics-Underserved Populations (RADx-UP) Initiative offers a timely perspective into strategies for supporting community-based testing to respond to COVID-19 surges and variants. In this policy paper, we propose a policy framework to identify common barriers to equitable COVID-19 testing and facilitate the scaling-up of the solutions that emerged to address them. We identify five key policy levers and three foundational components that are necessary to lead to measurable improvements in health equity. We aim for health leaders—including policymakers, community organizers, and other health care practitioners—to use these community-engaged policy strategies to inform community-based testing for future COVID-19 surges and variants.

Policy Levers

Equitable **access** requires removing barriers that prevent people from reaching COVID-19 testing sites

Efficient, transparent, and equitable **resource allocation** is needed to meet the needs of populations experiencing higher risk, vulnerability, or exclusion

Accurate and reliable **data** are crucial to support decision-makers to address health disparities and implement mitigation measures during the COVID-19 pandemic

Trustworthy, clear, and culturally responsive **communication and messaging** is needed to connect patients, providers, and communities to resources

Payment reforms that create incentives for quality of care and support innovative care management can accelerate efforts to advance health equity

Foundational Components

Community engagement promotes health equity, demonstrates the trustworthiness of health organizations in communities, and centers marginalized and minoritized voices

Cross-sector partnerships spanning health systems and communities they serve often have greater impact than efforts of any one stakeholder group acting alone

Regulatory guidance that seek to streamline processes, protect health data, and reduce administrative burden are important to support work within each policy lever

KEY STRATEGIES FOR COMMUNITY-BASED COVID-19 TESTING

We identified five key strategies for community-based COVID-19 testing based on real-world experiences from RADx-UP awardees and an environmental scan of the literature:

- *Extending the reach of existing health care infrastructure to expand access* includes creating additional sites, including walk-up testing sites, mobile testing sites, or at-home solutions, as well as funding community health workers (CHWs)
- *Using novel tools and measures to bolster equitable distribution and resource allocation* to identify communities burdened by high social and economic deprivation or comprising predominantly marginalized and/or minoritized populations
- *Increasing data protections and community feedback when standardizing data collection to address health inequities* includes deidentifying data, developing culturally sensitive common data elements (CDEs), and engaging communities in data collection
- *Creating transparent, community-informed communication and messaging* includes collaborating with trusted community leaders and supporting community input to build trust, allay concerns, and ensure messaging is culturally and linguistically responsive
- *Developing provider payments that facilitate community-based delivery of testing beyond a traditional clinical setting and reduce cost sharing for populations seeking testing* are key facilitators to increase testing uptake

LOOKING AHEAD: CONSIDERATIONS FOR POLICYMAKERS, PROVIDERS, AND RADX-UP PROJECTS

Community-based models that have promoted COVID-19 testing can be adapted more broadly to ensure individuals have access to health care resources that they trust and understand. Case examples in the policy paper illustrate the needed shift to support and finance community-based strategies, which have the greatest potential to sustainably reduce health disparities and bridge health equity gaps. Key steps policymakers, providers, and RADx-UP projects can take are:

- Develop accessible health services and public health interventions that overcome systemic inequities
- Allocate resources and services that address context-specific community barriers by using data tools and developing partnerships and networks
- Implement and operationalize data strategies that identify racial and ethnic disparities, embed community engagement, and support technical capacity
- Design communication and messaging strategies that reflect the community context and culture, use bidirectional channels, and embed cultural humility
- Advance payment reforms that support community-based care delivery models and remove systemic barriers to health services

Key Takeaways: Strategies to Embed Equity in COVID-19 Testing Efforts

For Policymakers:

- Extend health coverage to redress systemic inequities in insurance rates; support the development of equity-focused metrics; and support policies to extend services beyond traditional health care settings
- Encourage cross-sector data sharing to improve quality and timeliness of data application; and build on experience using disadvantage indices to identify geographic areas or populations exhibiting the greatest need for resources and COVID-19 testing
- Generate policies and funding mechanisms to modernize data management systems; support technical capacity for data de-identification and anonymization to help ensure compliance with privacy regulations (e.g., HIPAA) through data-sharing networks
- Support development of community advisory boards and consult community-partnership experts to encourage bidirectional communication; and support platforms and coalitions to embed community perspectives in communication strategies
- Create incentives to advance private and public payment models that include community health workers (CHWs)

For Providers:

- Expand walk-in/no appointment options; provide vaccination and testing beyond business hours; and partner with community-based organizations (CBOs) to organize events that are tailored to the cultural and linguistic needs of specific communities
- Collaborate with local health departments and CBOs to integrate real-time population-level data and identify communities experiencing vulnerability
- Use real-time, disaggregated data to understand gaps in service delivery and identify context-specific interventions
- Employ bilingual and bicultural staff to deliver care that is culturally and linguistically responsive; engage with local leaders to disseminate information; and respond to health concerns with empathy and cultural humility to build community connection and trust
- Support alternative payment models that embed health equity and support community-based care delivery models

For RADx-UP Projects:

- Deliver testing through community-centered delivery models (e.g., mobile testing and vaccine units, community-based primary care sites)
- Use disadvantage indices to generate data to address community-level health disparities; and partner with community health centers to identify communities experiencing higher risk for COVID-19 exposure and adverse outcomes
- Develop data visualizations to uncover trends and disseminate findings to inform decision making related to policies or specific tactics to increase COVID-19 testing; support alignment of data with community goals, including co-development of measures, data collection, and reporting plans
- Generate evidence on the most effective communication strategies to reach different communities; and test messaging with communities for key decisions and policies
- Use NIH funding to support CHW salaries and provide supports to help CHWs find sustainable career opportunities

Introduction

The COVID-19 pandemic has magnified how structural racism and other structural determinants of health affect the lived experience of marginalized and minoritized communities.[1-5] These populations include Black, Latino or Latinx, American Indian, Alaska Native, Asian, and Native Hawaiian and Pacific Islanders communities, as well as people who are incarcerated, low-income, or disabled, along with older adults, children, LGBTQIA, and pregnant people.[6-10] Studies show COVID-19 cases and deaths were highest among communities exhibiting greater social and economic risk factors (e.g., loss of employment) and occupational risk, including essential or front-line workers and communities with lower access to COVID-19 testing or social supports necessary to physically and socially distance.[11-15] Other studies note how COVID-19 testing was conducted through existing health care infrastructure, reinforcing patterns of systemic exclusion.[16] These factors increase the burden of disease on marginalized and minoritized communities, evidenced by recent data that show greater reductions in life expectancy and higher rates of COVID-19 associated orphanhood among Black and Latinx populations.[4,17,18] Achieving an equitable response to the COVID-19 pandemic and future public health emergencies requires policy solutions that remediate the structural inequities that underpin health disparities.

Community-based COVID-19 testing can ensure all populations have access to testing, which is a key step to linking people to treatment and reducing disparities in COVID-19 health outcomes. The National Institutes of Health (NIH) established the Rapid Acceleration of Diagnostics-Underserved Populations (RADx-UP) Initiative in April 2020 as part of a broader NIH initiative focused on scaling innovation, development, and commercialization of diagnostic tools to support COVID-19 testing. The RADx-UP Initiative is a $500 million investment aiming to test and scale community-engaged projects that seek to reduce disparities in COVID-19 testing access and uptake. To date, RADx-UP includes over 120 projects across 56 states, territories, and the District of Columbia. These projects serve communities in settings spanning community health centers, homes, schools, public housing units, nursing homes and long-term care facilities, and prisons or correctional facilities across urban and rural geographic areas. Duke University and the University of North Carolina (UNC) lead RADx-UP's Coordination and Data Collection Center (CDCC).

Analyzing lessons learned from RADx-UP offers a timely perspective into strategies for supporting community-based testing to respond to COVID-19 surges and variants as well as future public health crises. In this policy paper, we developed a framework for community-based COVID-19 testing that identifies common barriers and synthesize policy solutions to make COVID-19 testing more equitable. We aim for health leaders—including policymakers, community organizers, and other health care practitioners—to use these community-engaged policy strategies to inform community-based testing for future COVID-19 surges and variants. This research builds on ongoing projects at Duke and UNC, including RADx-UP's COVID-19 Equity Evidence Academy and the Duke-Margolis Center for Health Policy's COVID-19 testing and vaccination projects.[19-21] Section 1 proposes a framework for community-based COVID-19 testing based on learnings from the RADx-UP CDCC and identifies testing barriers across policy levers, Section 2 highlights testing strategies identified in the literature and those implemented by RADx-UP projects, and Section 3 offers policy considerations for local, state, and national health leaders to use as new COVID-19 variants emerge, as well as for other public health or population health efforts.

METHODOLOGY

Environmental Scan: We conducted an environmental scan of the literature to identify key strategies for reducing disparities in access to COVID-19 testing and highlight how RADx-UP project partners have addressed barriers through policy-focused solutions. We aimed to answer the following three research questions: 1) What are common barriers inhibiting COVID-19 testing? 2) What are emerging policy solutions to reduce disparities in access to COVID-19 testing? and 3) What are the policy implications for improving pandemic preparedness and the public health infrastructure? Our search strings included the following concepts: COVID-19, testing, and health disparities. We used articles identified through the environmental scan as

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well as articles identified by the RADx-UP Communications data profile team, meeting minutes in the RADx-UP Dashboard, and previous Duke-Margolis COVID-19 testing and vaccination reports to inform the development of the framework for community-based COVID-19 testing.

Case Study Screening and Selection: The team applied a systematic screening approach, based on available data, to identify case studies to illustrate the five health policy levers in the framework for community-based COVID-19 testing. We reviewed 69 Phase 1 (projects initiated before September 1, 2021) project summaries and myRADxUPhome project profiles, and collected descriptive information on geography, setting, communities served, type of testing or intervention, state political affiliation, and community principal investigator involvement. We created a shortlist of 10 projects to serve as illustrative examples of key policy levers aligned with the framework for community-based COVID-19 testing. We shared this shortlist with the Engagement Impact Teams who lead outreach to the RADx-UP projects. We conducted five semi-structured interviews with RADx-UP project leaders to inform case studies in the Appendix.

Limitations: Although we applied a methodical approach to the literature review, we did not conduct a rapid or systematic review, as it was not the purpose of this paper. Instead, our intent was to survey RADx-UP projects and target key policy concepts for supporting equitable COVID-19 testing strategies. Additionally, the team's initial screening process was limited to available information in the project summaries and project profiles. Finally, given the ongoing nature of the COVID-19 pandemic, policies related to testing continue to shift and have changed since the start of this research. The articles included in the environmental scan reflect data collected between March 2020 and February 2021.

Section 1: Framework for Community-Based COVID-19 Testing

Several systemic barriers, including systemic exclusion and structural racism, preclude populations from reaching health services in a timely manner.[22-27] Based on a review of the literature and RADx-UP projects, we developed a framework for community-based COVID-19 testing to illustrate five key policy levers—access, resource allocation, data, communication and messaging, and payment—and three foundational components—community engagement, cross-sector partnerships, and regulatory guidance (see Figure 1). In this section, we describe why each policy or foundational component matters in mitigating specific COVID-19 testing challenges and how each lever can advance health equity. Box 1 and Box 2 detail specific barriers and challenges for each policy lever and foundational component.

Meeting comprehensive needs of communities requires an intentional equity lens to redress historical and contemporary systemic exclusion.

POLICY LEVERS

Access: Access to care should be affordable, acceptable, and convenient to meet the health needs of local communities.[28] Increasing equitable access requires removing barriers that prevent people from accessing medications, attending appointments, scheduling visits, and receiving other essential health care services. Differential access to services results from many factors, including geography, distance, transportation, time of day, access to technology, cultural and linguistic relevancy, and social context. Meeting comprehensive needs of communities requires an intentional equity lens to redress historical and contemporary systemic exclusion. Disparities in testing location accessibility are well cited in the literature, particularly among Black, Latinx, American Indian, Asian American, and other marginalized and minoritized communities who are overrepresented in a number of frontline and essential industries.[29]

Resource Allocation: Resource allocation during a public health emergency requires consideration of ethics, equity, and efficiency to maximize benefit and mitigate disparities among populations experiencing higher risk for COVID-19 exposure and adverse outcomes. Further, resource allocation should support community-based solutions that address key gaps in public health infrastructure and make health care delivery more equitable, trustworthy, transparent, and sustainable. Allocation decisions influence who has access to health care resources, which have been scarce at times throughout the pandemic. For example, early in 2020, many testing sites required patients to present a doctor's referral or other documents (e.g., government-issued identification) in order to be tested.[30-32] While many of these early barriers have since been removed, resource allocation issues persist as testing expands to include more widespread use of at-home kits and rapid antigen tests.[33]

Data: Accurate and reliable data are crucial to support decision-makers in prioritizing resources to address health disparities and mitigation measures during the COVID-19 pandemic. Health leaders can use these data to rapidly identify communities experiencing vulnerability, develop action plans to address equity gaps, and communicate critical information to necessary stakeholders. Data collection efforts that respect community values, cultural humility, and data protections while building public trust are needed to achieve responsible and equitable policy decisions. Growing evidence shows that including community members and representatives from local organizations in the design, implementation, and evaluation of data can lead to a deeper, more informed understanding of health disparities.[34-36] Data can also increase awareness of local testing needs among different geographic areas and marginalized and minoritized communities. Early pandemic response efforts highlighted several data challenges.

Communication and Messaging: Audience-tailored health messaging that is clear, trustworthy, and culturally responsive can improve communication and support public health interventions. Employing communication strategies that uphold these principles can help mitigate public health crises, motivate the public to engage in health-promoting behaviors, and prevent further systemic exclusion from health care services. Initial state and federal communication about the pandemic was slow, confusing, and decentralized—where discrepancies arose across local, state, and federal messaging.[37] For example, limited consistent circulation of COVID-19 testing information on local news stations, radio, and social media networks is cited as an early communication failure.[38]

Audience-tailored health messaging that is clear, trustworthy, and culturally responsive can improve communication and support public health interventions.

Payment: Payment reforms that create incentives for quality of care and support innovative care management can accelerate efforts to advance health equity and reduce health disparities. COVID-19 has highlighted how traditional payment and service delivery models can exacerbate health inequities and fail to address the root causes of health disparities. As health systems and states are experimenting with promising alternative payment models to reach communities experiencing the greatest impact of COVID-19 or expand wraparound services (or strategies that extend beyond the health care sector to provide comprehensive care to address social needs), additional efforts are needed to align payment with interventions that address structural and social determinants of health.[39,40] Although newer value-based payment models have prioritized value over quantity, these payment models have struggled to reduce health disparities.[41] Initial guidance on the patient costs related to testing and the financial consequences of testing positive for COVID-19 created barriers for individuals.

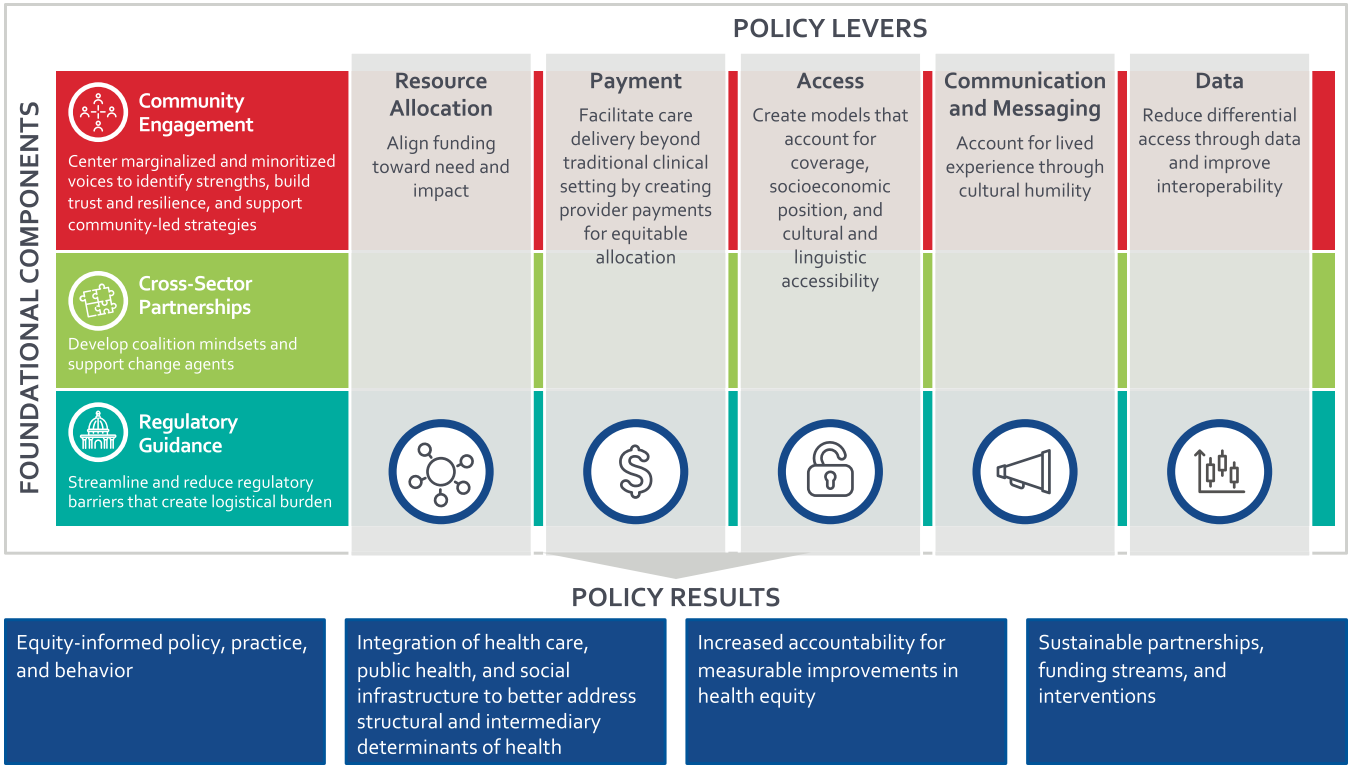
FOUNDATIONAL COMPONENTS

Community Engagement: Community engagement promotes health equity, demonstrates the trustworthiness of health organizations within a community, and centers marginalized and minoritized voices. Community-led solutions can be developed by creating financial and non-financial mechanisms to support existing or new community-led initiatives. Developing robust community partnerships takes time, trust, and equity-informed perspectives, and there is no one-size-fits-all approach to community engagement.[42-44] Community engagement can include (but is not limited to) outreach, consultation, collaboration, shared decision-making, and joint data collection.[45] However, initiating community partnerships requires time and commitment, especially with communities that have been historically mistreated by government and research institutions. Public health interventions that lack community-engaged principles risk not addressing the root causes of health disparities.

Cross-Sector Partnerships: Creating partnerships across sectors helps foster coalition mindsets and develop multi-pronged responses.[46] As identified by the case studies included in this paper, coalition initiatives spanning health systems and the communities they serve often lead to greater impact than the efforts of any one stakeholder group acting in isolation. Health leaders can engage in shared decision-making structures that align stakeholder priorities and address logistical barriers.

Regulatory Guidance: Policy approaches that seek to streamline regulatory processes, protect health data, and reduce regulatory administrative burden are important to supporting work within each policy lever. Regulatory reform should center decision making within communities while facilitating quality, safety, and information sharing. With the recent expansion of telemedicine and digital-health tools, further advancements could lead to improved patient access, resource allocation, and public health data sharing through safe and secure networks. Regulatory gaps and barriers continue to place unnecessary burdens on efforts to advance health equity and COVID-19 testing.

Figure 1: Policy Framework for Community-Based COVID-19 Testing



Box 1: Challenges and Barriers to Policy Levers

Access:

- **Limited paid time off** to seek COVID-19 testing and **limited sick leave** if a person receives a positive test result often prevent essential workers from accessing testing.[15]
- Individuals may **fear harassment and other repercussions** due to their absence from work.[47] Furthermore, immigrants may be more likely to avoid testing due to the fear that it could impact their or a family member's immigration status.[30,48]
- **Limited access to transportation or potential costs to reach testing sites**, particularly as access to public transportation fluctuates throughout the pandemic with reduced services and route closures.[13,15,30,49,50]
- **Lack of culturally and linguistically responsive models** make it harder for non-English speakers to access testing sites, especially when translation services are unavailable.[51-53]
- Financial barriers and **lower insurance coverage rates among minoritized and marginalized populations** result in reduced health care access.[54]
- **Unemployment can be a barrier to COVID-19 testing**, especially as some workers rely on employer-sponsored health insurance.

Resource Allocation:

- **Prioritization of speed over equity in resource allocation widens disparities** in health outcomes.[21]
- **Requirements such as identification documents and referrals create additional barriers** for communities and populations that are systemically excluded from health care systems or lack access to primary care or pharmacy networks.
- **Technical and administrative burden** impacts state, local, federal, and community organizations. Many organizations encounter operational barriers and bandwidth constraints while managing the influx of state and local fiscal recovery funds and completing required reporting documents.[55]
- Funding to community-based organizations or other community partners is tied to COVID-19 efforts, which threatens **sustainability of community-based models** beyond the pandemic.

Data:

- **Data stratified by race, ethnicity, and other sociodemographic factors are still missing or incomplete** in some electronic health records (EHRs) and public health data systems. Further, reporting procedures across states are not standardized.[56,57]
- **Many populations remain underrepresented in COVID-19-related data registries** (e.g. American Indian communities and lesbian, gay, bisexual, transgender, and queer [LGBTQIA] communities), which makes population-level trends difficult to monitor.[58,59]
- **Data aggregation and absence of community insights can exacerbate false narratives**, further misinformation, obscure disproportionate impact on multiethnic communities (e.g., Asian American/Pacific Islander and Latinx), and make it difficult to track trends among subgroups in communities.[60,61]
- **Navigating IRB approvals, data use agreements, electronic data capture requirements, and study design limitations** poses administrative burdens on local and community organizations.
- **Tribal Nations face unique data concerns due to historic governmental abuse of tribal sovereignty and data sovereignty** even though treaties and federal law protect the right for Tribes to own and manage their biodata.[62,63]

Box 1: Challenges and Barriers to Policy Levers (cont.)

Communication and Messaging:

- **Common misperceptions about COVID-19 testing discourage people from seeking services.** For example, perceptions about pain associated with the nasal swab method and fears that testing causes COVID infection have been cited as a deterrent to uptake.[49,51]
- **Confusing and contradictory messaging** reduces uptake of testing services. For example, despite COVID-19 testing being advertised as free, Black and Latinx communities continue to fear that they will be charged for the test after they receive it or that the uninsured will receive lower quality care at testing facilities.[49,64]
- **Public health communications that do not take cultural, linguistic, and historic context into consideration** are inaccessible and often untrustworthy to communities.[65-67] For example, materials have often been translated from English to another language without accounting for cultural nuances in interpretation of information.

Payment:

- Services provided by **CHWs or other non-clinical health providers are not consistently reimbursed** in fee-for-service or alternative payment models, making it difficult to develop and sustain a workforce that includes trusted members of the community.[68,69]
- **Addressing racial and ethnic disparities requires additional payment and care delivery reforms**, including equity-informed quality improvement or measurement and primary care transformation.[70]

Box 2: Challenges and Barriers to Foundational Components

Community Engagement

- **Systemic exploitation** of marginalized and minoritized communities in the United States (US), including for medical and public health research gains prevents these communities from positive encounters with the health system.[23,71-73]
- **Systemic exclusion** of marginalized and minoritized communities from spheres of political, social and economic power can manifest in power imbalances within partnerships.[23]
- Differences in perspectives, concerns, values, beliefs, and language can create **disparate priorities between public and community leaders**.
- **Community partnerships take time, commitment, and interpersonal competencies** to develop successfully. For example, health professionals need adequate context to understand unique community-level issues and barriers, as well as cultural humility, communication skills, and long-term commitment to partnership to foster and maintain mutually beneficial relationships with community partners.

Cross-Sector Partnerships:

- **Historically, the US health care system has created few incentives** for providers and insurers to collaborate with cross-sector partners to mitigate structural determinants of health.[74,75] Some recent alternative payment models cover costs related to social needs, but further reforms are needed to advance health equity.[76]
- **Limited collaboration with community partners is perpetuated by institutional barriers** such as the misalignment of funding, policies, regulations, data management practices, training, and evaluation metrics, as well as the lack of incentives to collaborate.
- **Conflicting goals, perspectives, norms, and organizational cultures** across stakeholder groups challenge decision-making and consensus.

Regulatory Guidance:

- The Clinical Laboratory Improvement Amendments (CLIA) make it **difficult to provide routine COVID-19 testing in non-medical settings** (e.g., workplaces, businesses, and community organizations).[77] CLIA are a set of regulations applicable to all laboratory testing performed on human subjects in the US. Clinical laboratories are required to be certified by the Centers for Medicare & Medicaid Services (CMS) to accept human samples for diagnostic testing.
- **Existing privacy laws have struggled to keep pace during the COVID-19 pandemic.** Legacy statutes like the Health Insurance Portability and Accountability Act (HIPAA) of 1996, along with the Health Information Technology for Economic and Clinical Health Act (HITECH) of 2009, are often difficult to comply with and inadequate to facilitate safe information exchange in today's digital health sector.[78] The result is a patchwork of health privacy and data protection laws that are in need of updates and may compromise public trust.

Section 2: Testing Strategies Across Policy Levers

This section identifies testing strategies to overcome policy barriers based on an environmental scan of the literature and semi-structured interviews with RADx-UP projects. We highlight five RADx-UP projects identified through a review and shortlist process, describing key strategies each project site has implemented (see Appendix for case examples). Table 1 summarizes an illustrative list of strategies by policy lever that RADx-UP projects have implemented.

POLICY LEVER 1: ACCESS

Extend the reach of existing health care infrastructure to expand access

Efforts to promote access have included creating additional COVID-19 testing sites, including walk-up testing sites that eliminate the requirement to have a car to be tested, mobile testing sites, and at-home solutions.[49] Other efforts include developing community partnerships and creating multilingual testing sites to ensure cultural and linguistic acceptability.[50,79] For example, one clinic in Louisiana partnered with local Spanish radio stations and immigrant advocacy groups to inform Spanish speakers about COVID-19 testing options.[47] Other localities across the country have expanded access by offering a multilingual helpline and translators to increase access for Asian Americans in the community.[52]

Mobile testing sites have been designed to provide testing for transmission hotspots in marginalized and minoritized communities. For instance, mobile testing facilities were introduced in Utah, and sites moved every 2 to 3 days to ensure adequate access to testing for hotspot locations.[80] Chicago implemented a similar program, in which mobile sites were allocated to ZIP codes with the highest 7-day average of positive test results and remained in place for 1-2 days before being redeployed elsewhere.[81] People who participated in this program were more likely to be Hispanic, low-income, or both, indicating that mobile sites effectively reached the desired populations.[81] In New Orleans, mobile testing programs reduced travel barriers and increased the testing uptake among African Americans and Asians in the area.[82]

RADx-UP projects including **Project 18: Florida International University**, **Project 22: University of Oklahoma Health Sciences Center**, and **Project 23: West Virginia University** deployed mobile COVID-19 testing units to marginalized and minoritized communities, under-resourced communities, and counties with anticipated near-term increases in COVID-19 incidence. **Project 34: University of Kansas Medical Center** helped develop 'Local Health Equity Action Teams' with local health departments and safety-net clinics (or medical centers that provide healthcare to individuals regardless of insurance status or ability to pay) to improve accessibility of COVID testing services. **Project 48: University of North Carolina** (see case example here) increased efforts to connect populations to health services by removing technological and language barriers. Also see **Project 56: Rush University Medical Center** in the Appendix.

POLICY LEVER 2: RESOURCE ALLOCATION

Use novel tools and measures to bolster equitable distribution and resource allocation

Testing models have adopted novel tools and measures to identify communities experiencing the greatest impact of COVID-19, which include communities burdened by high social and economic deprivation (i.e., communities with limited access to health-promoting, social, or economic resources due to structural discrimination and disadvantage) or composed of predominantly marginalized and/or minoritized populations. For example, the Utah Department of Health tracked transmission hotspots in marginalized and minoritized communities to select sites for mobile testing units.[50] Cities such as New York and Chicago made efforts to locate testing sites in neighborhoods experiencing vulnerability and increase placement of testing sites in predominantly Black and Latino neighborhoods.[81,83] Localities and states have also used disadvantage indices, which are tools that combine separate variables to determine the average level of disadvantage experienced by people living in a particulate geographic area. Although needs-based assessments that account for social vulnerability and disadvantage have been widely adopted, some critics of these strategies raise ethical and legal concerns about using some of these methods for resource prioritization because of the inclusion of factors like race and ethnicity.[84]

RADx-UP projects including **Project 5: Emory University**, **Project 25: Arizona State University-Tempe Campus**, and **Project 49: University of Alabama at Birmingham** have utilized geographic information systems (GIS) to pinpoint priority testing communities, or areas where access to COVID-19 testing centers is limited or not available at all. Other projects, such as **Project 37: Rutgers Biomedical and Health Sciences** (see case example here), are using disadvantage indices, such as the Centers for Disease Control and Prevention's (CDC's) Social Vulnerability Index (SVI), to inform their COVID-19 programs and services. Also see **Project 24: Brown University**, **Project 48: University of North Carolina** and **Project 56: Rush University Medical Center** in the Appendix.

POLICY LEVER 3: DATA

Increase data protections and incorporate community feedback when standardizing data collection to address health inequities

The absence of community feedback in current data collection, reporting, and clinical research processes has exacerbated long-standing community mistrust due to historical and contemporary trauma. Strategies to address data challenges include deidentifying data, developing culturally sensitive common data elements (CDE), and engaging communities in data collection efforts are important for overcoming privacy concerns and language barriers, and addressing technical data challenges when they arise. For example, CDEs are tools that combine a defined set of research questions with a group of responses allowing standardization across multiple datasets.[85] CDEs can facilitate cross-study comparisons and meta-analyses, simplify training and operations, and promote interoperability between different systems to improve data collection and data sharing. Embedding community participation in the development of CDEs can generate actionable data, refine tools for understanding cultural nuances, and examine population-level details of disease burden across the US.[85] Similar standardization efforts are needed to support development of data visualization tools, which help highlight COVID-19 disparities and provide a better understanding of local trends in illness by race, ethnicity, and public setting.[86] Such visualization strategies can help communicate information more broadly, identify and track infection patterns, and provide insights necessary to develop hypothesis-driven research questions.[87]

RADx-UP projects utilized EHRs to facilitate real-time monitoring of the virus and address barriers to COVID-19 mitigation services. For example, **Project 63: New York University Grossman School of Medicine** used EHRs and self-reported survey data to identify structural and social barriers to COVID-19 testing and vaccine uptake. **Project 35: University of Utah** and **Project 24: Brown University** (see case example here) used EHRs, real-time policies/recommendations, and additional data from the state department of health on hotspots to identify populations experiencing higher risk for COVID-19 exposure and adverse outcomes. Those populations received text messaging and patient navigation to facilitate both testing and vaccination. Other projects, such as Project 17: Cherokee Nation and **Project 33: Medical College of Wisconsin**, created data dashboards using community-, city-, and county-level data to inform COVID-19 response efforts and estimate the progression of risk. Also see **Project 37: Rutgers Biomedical and Health Sciences** in the Appendix.

POLICY LEVER 4: COMMUNICATION AND MESSAGING

Develop transparent, community-informed messaging and communication

Transparent and clear messaging about what COVID-19 testing entails is a critical component of successful testing initiatives.[64] Such campaigns employ strategies that build trust, allay concerns, and combine discussion with education.[20,88] For example, provider communications that describe discomfort associated with nasal swab tests, accompanied by reassurance that discomfort is brief, and offer education on the different types of testing options available (e.g., oral swab, saliva sample) have improved the acceptance of testing.[89] Engaging community leaders and forging community partnerships to elevate awareness of COVID-19 testing communications has also been a critical strategy in many localities.[56,81] Strategies to allay concern and encourage COVID-19 protective behaviors include a focus on recruiting leaders and public figures in health care, government, and public health to communicate information about the novel disease and how to reduce risk of exposure through safety measures (e.g., social distancing and wearing masks).[37]

RADx-UP projects at **Project 66: Howard University** and **Project 44: University of Missouri-Kansas City** collaborated with trusted community messengers and faith leaders to disseminate information and have frank dialogues with community members about the importance of testing, while **Project 55: University of Hawaii at Manoa** engaged community members and leaders to assist with study recruitment and data collection. Other projects, such as **Project 42: University of Illinois at Chicago**, **Project 68: University of California, San Francisco**, and **Project 36: The Ohio State University**, have used community-engagement strategies to center community voices in the development of culturally and linguistically responsive COVID-19 messaging. **Project 62: University of South Florida** (see case example here) implemented community *charlas* community discussion groups facilitated by promotoras and USF research staff, to better improve messaging. Also see **Project 37: Rutgers Biomedical and Health Sciences**, **Project 48: University of North Carolina**, and **Project 24: Brown University** in the Appendix.

POLICY LEVER 5: PAYMENT

Develop provider payments that support community-based delivery of testing and reduce cost sharing for populations seeking testing

The most significant policy solution resolving payment challenges was the implementation of free testing at the point-of-care. In March 2020, the federal government passed HR6201 in the Families First Coronavirus Response Act, which enacted free COVID-19 testing and removed associated travel costs.[15] Further, to address the unique challenges of the pandemic, CMS and private insurers granted new adjustments to increase flexibility in current payment models.[90] In another example, the Veterans Health Administration provided subsidized or free health care to veterans, which helped reduce the barriers to COVID-19 testing for these populations.[91] The Health Resources & Services Administration also covered testing claims for uninsured populations; however, this policy measure ended in March 2022.[92] In New Orleans, community-based mobile health sites were established with free testing at the point-of-care.[82] These same strategies were cited as facilitators for testing uptake among Black communities in urban and rural Alabama.[49] In the state of New York, private insurance companies were required to waive cost sharing for COVID-19 testing, which helped protect patients from some of the cost burden of COVID-19 services. Other strategies included service models that reached uninsured individuals and were flexible to the changes caused by COVID-19. In Louisiana, an FQHC created a COVID-19 walk-in clinic to address the emergent demands of the pandemic while balancing the continuation of routine non-COVID-19 services.[47]

RADx-UP projects including **Project 69: Xavier University of Louisiana** and **Project 51: University of Texas at El Paso** have facilitated care delivery in expanded care settings by maximizing resources and leveraging community-health workers in strategic partnerships with the local health department, county hospital, community pharmacists, FQHCs, churches, food banks, schools, grocery stores, and other local businesses. **Project 56: Rush University Medical Center** (see case example here) established a more sustainable funding model for their testing sites by hiring CHWs as full-time employees rather than part-time contractors. Also see **Project 62: University of South Florida** in the Appendix.

Table 1: Illustrative Implementation Strategies by RADx-UP Projects for Each Policy Lever

Policy Lever and Strategy Category	RADx-UP Projects
Access	
Developing infrastructure to support CHW-driven initiatives and community collaboratives	**Project 4: A Nurse-Community Health Worker-Family Partnership Model to Increase COVID-19 Testing in Urban Underserved and Vulnerable Communities (New York University and Duke University School of Nursing):** Implemented Nurse-Community Health Worker-Family Partnership intervention to increase reach, acceptance, and uptake of diagnostic testing, adherence to COVID-19 prevention strategies, and development of a household mutual aid strategy to respond to COVID-19-related events within the home and community **Project 51: Implementing Community-based Approaches to Increase SARS-CoV-2 Testing among an Underserved and Vulnerable Hispanic Population (University of Texas at El Paso):** Formed part of a countywide collaborative to train and deploy CHWs to conduct COVID-19 outreach and navigation to testing resources to over 100,000 community members at tabling events (churches, food banks, schools, grocery stores, and businesses) in underserved areas
Utilizing mobile testing	**Project 18: Community-Engaged Research on COVID-19 Testing Among Underserved and/or Vulnerable Populations (Florida International University):** Deployed a mobile COVID-19 testing unit to geographic areas occupied by medically underserved and marginalized communities **Project 22: Community-Engaged Approaches to Testing in Community and Healthcare Settings for Underserved Populations (CATCH-UP) (University of Oklahoma Health Sciences Center):** Deployed mobile testing units in community settings that provided operational support to increase the efficiency and capacity for state-wide testing by Oklahoma's public health authorities **Project 23: Developing Novel Strategies to Increase COVID-19 Testing among Underserved and Vulnerable Populations in West Virginia through Community and State Partnerships (West Virginia University):** Surveillance testing using mobile vans in counties with anticipated near-term (within 7 days) increases in COVID incidence and in in rural and minority communities utilizing culturally competent staff and procedures
Community-Public Health partnerships	**Project 34: Improving the Response of Local Urban and Rural Communities to Disparities in COVID-19 Testing (University of Kansas Medical Center):** Supported the development of 'Local Health Equity Action Teams' in 10 Kansas counties to work with local health departments and safety-net clinics on improving accessibility of COVID testing services for high-risk and underserved community members
Resource Allocation	
Identifying communities that do not have access to COVID-19 testing	**Project 5: Rapid Optimization of COVID-19 Testing for People Affected by Diabetes (Emory University):** Used geocoded, individual-level data to identify "testing deserts" so that resources can be shifted as needed to reach the most marginalized and minoritized communities
Utilizing disadvantage indices to identify high-deprivation communities to direct testing efforts	**Project 49: COVID-19 Testing Model among Vulnerable Populations: From Community Engagement to Follow-Up (University of Alabama at Birmingham):** Used geographic information system (GIS) mapping that combined SVI with COVID-19 incidence data to implement, in collaboration with community partners, a program of mobile testing sites located in marginalized and minoritized communities with alternating days/times of availability to allow residents easier access to testing **Project 25: A Survey Related to Eliminating COVID-19 Disparities in Arizona in Partnership with Underserved/Vulnerable Communities (Arizona State University-Tempe Campus):** Used geographic information systems (GIS) to identify priority testing communities

Policy Lever and Strategy Category	RADx-UP Projects
Data	
Utilizing electronic health records (EHRs)	**Project 63: Project pErception of coVID tEsting aNd vaCcinE (EVIDENCE) (New York University Grossman School of Medicine):** Partnered with Family Health Centers/Federally Qualified Health Centers (FQHCs) to use EHR data to identify social and structural barriers that lead to reduced testing and vaccine uptake among underserved populations (Black and Latinx) **Project 35: Community-Academic Partnership to Address COVID-19 Among Utah Community Health Centers (University of Utah):** Utilized EHR data from over 124,000 patients at 25 clinics and real-time data/recommendations from the state department of health to facilitate testing and vaccination via text messaging and patient navigation
Creating data dashboards using community, city, and county level data	**Project 33: FightCOVIDMKE (Medical College of Wisconsin):** Estimated progression risk by creating a "synthetic" Milwaukee using the tested population and combining this information with data on deceased patients and hospitalized patients **Project 17: A Cherokee Nation Community-Driven Program for Testing and Contact Tracing (Cherokee PROTECT) (Cherokee Nation):** Created weekly maps of all patients who were tested and those who tested positive, as well as Cherokee Nation Health System testing locations using geocoded address data from tested patients **ABC Science Collaborative:** Modeled the implementation of bidirectional data sharing to help school leaders make informed decisions about returning to school and keeping staff and students safe as well as provided recommendations for evidence-based safety measures*
Communication and Messaging	
Collaborating with trusted community messengers and faith leaders	**Project 66: Howard University Research Center for Minority Health and Health Disparities (Howard University):** Engaged community faith leaders to have frank dialogues about emerging science and hesitancy among 500 African Americans in the DC metropolitan area **Project 55: Puipuia le Ola: Increasing Reach and Uptake of COVID-19 Testing Among Pacific Islanders in Hawaii and Guam (University of Hawaii at Manoa):** Recruited through respondent-driven sampling "initial seeds" at places of work, recreation, and worship who identify as Pacific Islanders in both Hawaii and on Guam, and these "seeds" then recruited other community members from their own networks to complete the survey, who become seeds, and so forth **Project 44: COVID-19 Testing and Linkage to Care with African American Church and Health Agency Partners (University of Missouri-Kansas City):** Trained church health workers to deliver a "Faithful Response COVID19 Tool Kit" which includes easy-to-use digital tools to help community members navigate COVID-19 testing services **Project 68: Getting Asian Americans INFORMED to Facilitate COVID-19 Testing and Vaccination (University of California, San Francisco):** Trained lay health workers as "health messengers" to recruit and deliver COVID-19 related information to members of Chinese, Hmong, and Vietnamese communities via text messaging and zoom video conferencing
Encouraging community input to ensure messaging is culturally and linguistically responsive	**Project 42: Investigating the Effectiveness Of COVID-19 Testing Choices, Community Engagement, and Culturally-Embedded mHealth Literacy Delivery in a Medically-Underserved, Community-Based Sample (University of Illinois at Chicago):** Expanded community-based testing by engagement of community champions, who co-created and distributed project-related social media, radio, and community-TV advertisements, COVID-19 literacy flyers and posters, and the culturally embedded and multilingual "mHealth COVID-19 Literacy & Outreach Suite" **Project 68: Getting Asian Americans INFORMED to Facilitate COVID-19 Testing and Vaccination (University of California, San Francisco):** Conducted in-depth prospective investigation of sociocultural, ethical, and behavioral factors related to COVID-19 testing in Chinese, Hmong, and Vietnamese Americans **Project 36: IMProving Access to Covid Testing in Ohio (IMPACT-Ohio) (The Ohio State University):** Developed virtual platforms to center community voices and understand historical and contemporary mistrust and encouraged community input to ensure messaging was culturally and linguistically responsive

**ABC Science Collaborative was funded through a partnership with the RADx-UP CDCC but not through RADx-UP grant funds given to projects.*

Policy Lever and Strategy Category	RADx-UP Projects
Payment	
Facilitate care delivery in expanded care settings	**Project 69: Assessing Vaccine Hesitancy and a Pharmacist Led Intervention Model to Increase COVID-19 Vaccine Uptake Among African Americans (Xavier University of Louisiana):** Compensated community pharmacists to relay information and messaging at community pharmacies (independent and chain) based on immunization rates in the parishes (counties) they serve **Project 51: Implementing Community-based Approaches to Increase SARS-CoV-2 Testing among an Underserved and Vulnerable Hispanic Population (University of Texas at El Paso):** Funded CHWs to conduct door-to-door outreach to increase awareness of testing resources

Section 3: Considerations for Policymakers, Providers, and RADx-UP Projects

Lessons learned from the last two years can facilitate more equitable COVID-19 testing strategies and offer important implications for policy directions as new COVID-19 variants emerge. For example, as test-to-treat programs develop, there are opportunities for policymakers, providers, and RADx-UP projects to adopt strategies outlined in this framework to connect communities to needed resources and test-to-treat services. Test-to-treat programs can help facilitate necessary treatments for individuals who are connected to formal health care settings (e.g., primary care clinics and pharmacies), but pose challenges for communities systemically excluded from these settings. Therefore, strategies that redress systemic inequities and connect communities to testing will help improve equity by protecting all populations and connecting people to treatment as early as possible. Using the Policy Framework outlined in Section 1, this section outlines actionable solutions different stakeholders can take to advance equitable COVID-19 responses by policy lever. These solutions have broader implications for reducing disparities through public health or population health efforts.

Solution 1: Develop accessible health services and public health interventions that overcome systemic inequities

Relying on traditional health care networks without creating new pathways for care delivery can perpetuate health disparities in access to COVID-19 testing and other health services. Initially, COVID-19 testing sites were organized through existing health care infrastructure, such as hospitals, local health departments, and other formal health care settings, resulting in limited access to services for many marginalized and minoritized communities.[50,93] Each community has different assets and needs; therefore, care delivery requires context-specific knowledge of available community networks and infrastructure.[16,20] For example, in communities where pharmacies are plentiful and have accessible hours, delivering COVID-19 tests at pharmacy locations may be an appropriate strategy. However, in settings where pharmacies are difficult to reach, other community-based locations may be more appropriate for COVID-19 testing clinics. Key lessons and solutions for stakeholders include:

- **Providers** can expand walk-in/no appointment options, provide vaccination, testing or therapeutics after business hours and on weekends, and partner with community-based organizations to organize events that are tailored to the cultural and linguistic needs of specific communities.
- **Policymakers** can consider policies that extend health coverage to redress systemic inequities, such as race-, ethnicity-, and income-based disparities in insurance rates, that underpin differential access to health services. Other policy steps include supporting the development of metrics that measure distribution of testing relative to share of total population or share of case rates or mortality, and supporting policies to extend services beyond a hospital, health system, or pharmacy setting.
- **RADx-UP projects and community partners** can deliver testing through community-centered delivery models, such as mobile units or community-based primary care sites, which can overcome barriers that communities experiencing systemic exclusion face.

Solution 2: Allocate resources and services that address context-specific community barriers by using data tools and developing partnerships and networks

Many strategies have successfully used disadvantage indices to increase access to testing to populations that need it most.[94] Disadvantage indices use publicly available demographic and population-level data to facilitate identification of place-based patterns of social and environmental risk. Specifically, indices combine indicators across different social determinants of health domains to rank relative geographic-level disadvantage. For example, the CDC's SVI data were used to determine where people

experiencing higher risk for COVID-19 exposure resided. Key lessons and solutions for stakeholders include:

- **Providers** can collaborate with local health departments and community-based organizations to integrate real-time population-level data and identify communities experiencing vulnerability.
- **Policymakers** can encourage cross-sector data sharing in the design and implementation of disadvantage indices to improve quality and timeliness of their application. Policymakers can build on their experience using the SVI and other disadvantage indices, including the Pandemic Vulnerability Index (PVI), to inform the equitable allocation of vaccines and testing resources, and to pinpoint ZIP codes with the highest caseloads of COVID-19 to identify geographic areas or populations experiencing the greatest impact of COVID-19.[94]
- **RADx-UP projects and community partners** can use tools such as disadvantage indices to identify and generate data to address community-level health disparities. They can also partner with FQHCs and community health centers that serve minoritized and low-income populations to designate services to expand prevention and treatment to populations experiencing higher risk for COVID-19 exposure and adverse outcomes. For example, vaccinations conducted at FQHCs have closed racial and ethnic gaps in vaccination rates.[95]

Solution 3: Implement and operationalize data strategies that identify racial and ethnic disparities, embed community engagement, and support technical capacity

Community engagement during data collection and reporting is an important strategy to achieve data equity, which means ensuring an equity lens is applied to data collection, analysis, interpretation, and dissemination across stakeholders. Data equity can also demonstrate trustworthiness, align strategies to community goals, promote the sustainability of interventions, and address systemic deficits in data. Community-informed data can align strategies to community goals and facilitate real-

time decision making in public health interventions. When developing a data collection and reporting plan, health leaders consider many factors including what and how data are collected with communities, data governance, data sovereignty, and data sharing and use. Key lessons and solutions for stakeholders include:

- **Providers** can use real-time, disaggregated data to understand gaps in service delivery and identify context-specific interventions. Data disaggregation can be a useful tool for uncovering underlying trends and patterns across differentially grouped dimensions such as sex, age, geographic location, minority status, race, ethnicity, and other sociodemographic or socioeconomic variables.[96] In addition, data disaggregation can deliver a more accurate profile of existing access disparities, which may be obscured when aggregated.[97]
- **Policymakers** can generate policies and funding mechanisms to support the modernization of data management systems to meet real-time analysis demands and provide guidance on uniform data collection and reporting processes across sectors. Further, policymakers can support technical capacity for data de-identification and anonymization to help ensure compliance with privacy regulations (e.g., HIPAA) through data-sharing networks. Another policy step is to advance quality standards that treat equity as an inextricable and cross-cutting component of quality.
- **RADx-UP projects and community partners** can develop data visualizations to uncover trends and patterns, disseminate findings back to communities, and inform decision making related to policies or specific tactics to increase COVID-19 testing. Projects can also continue to support efforts to align data collection with community goals, including through co-development of measures and data collection and reporting plans.

Solution 4: Design communication and messaging strategies that reflect the community context and culture, use bidirectional channels, and embed cultural humility

Efforts that elevate trusted voices and incorporate community feedback for key public health communications and policies can ensure nuanced messaging and help allay fear and concerns related to medical mistrust. A key step of these approaches includes developing communication and messaging based on cultural humility. Cultural humility involves understanding how lived experiences informed by race, ethnicity, language, age, gender identity, sexual orientation, immigration status, housing status, disability status, political affiliation, and value systems shape how people access health information. Strategies that incorporate understanding of cultural nuances, values, beliefs, and systemic barriers into messaging and communication move beyond translation. This is an

important step to account for within-group differences (e.g., different Latino or Latinx communities will require community-specific messaging and wording). Key lessons and solutions for stakeholders include:

- **Providers** can provide translation services for care delivery services, employ bilingual and bicultural staff to deliver care that is culturally and linguistically responsive, and engage with local leaders to disseminate information. Furthermore, training for providers on how to respond to health concerns with empathy and cultural humility can be established to build community connection and trust.
- **Policymakers** can support development of community advisory boards and consult community-partnership experts to encourage bidirectional communication and ensure communication is transparent. Communities have often reported that they have received mixed and sometimes conflicting messaging from various trusted sources. Coalitions such as Latinx Advocacy Team & Interdisciplinary Network for COVID-19 (LATIN-19) and the African American COVID Taskforce Plus (AACT+) in North Carolina provide platforms to embed community perspectives in communication strategies.[16] Such products can include short, clear videos from health professionals and simple infographics with visual aids.
- **RADx-UP projects and community partners** can generate evidence on the most effective communication strategies to reach different communities and test messaging with priority population groups for key decisions and policies. For example, even when tests were available free of charge to populations who were uninsured, many individuals feared that they will be charged for testing due to past experiences interacting with the health system. As a result, documenting and conveying lived experiences is still needed to inform policy guidance and interventions.

Solution 5: Advance payment reforms that support community-based care delivery models and remove systemic barriers to health services

CHWs, or promotoras de salud in Spanish, and community pharmacists have been shown to be integral team members for testing delivery teams. Institutionalizing the payment structure for CHWs or community-based organizations conducting community outreach is needed to ensure sustainability and continuity of services. In addition, the COVID-19 pandemic has highlighted gaps in funding for social services that greatly impact the physical and mental wellbeing of individuals. This includes services such as transportation to and from testing and vaccination sites, services to ensure safe working conditions, childcare, and access and ability to afford healthful food. Key lessons and solutions for stakeholders include:

- **Providers** can support alternative payment models that embed health equity and support community-based care delivery models. Such payment reforms are in line with CMS's 5-year strategic plan, as well as build on multiple Medicaid Section 1115 waivers that have expanded partnerships between states' Medicaid accountable care organizations and social service organizations.[40,98]
- **Policymakers** can establish a state-based CHW advisory board and state-based curriculum for CHWs, offer incentives to private insurers that expand models that include CHWs, incorporate CHWs into Medicaid administrative cost claims, and increase grant funding for outreach conducted by CHWs. Additional policy reforms focused on quality measures that treat equity as an inextricable and cross-cutting component of quality can help operationalize payment reforms aiming to address health inequities.[99,100]
- **RADx-UP projects and community partners** can use NIH funding to support CHW salaries and provide supports to help CHWs find sustainable career opportunities.

Conclusion

At the start of the COVID-19 pandemic in 2020, major obstacles to testing were glaring: systemic exclusion from existing health networks limited access to COVID-19 mitigation services, early resource allocation efforts prioritized speed over equity, technical challenges impacted data reporting and collection, public health communications were confusing and culturally and linguistically inaccessible, and the inability to pay for COVID-19 testing inhibited individuals from seeking care. As new variants emerge and guidance on COVID-19 safety protocols waxes and wanes, it is important to build on lessons from the last two years to avoid replicating the same challenges and ensure that marginalized and minoritized communities can access COVID-19 testing. Community-based models that have promoted COVID-19 testing can be adapted more broadly to ensure individuals have access to health care resources they trust and understand. The policy levers highlighted in this paper demonstrate key areas for health policy action. Specifically, the RADx-UP case examples demonstrate the feasibility of designing community-engaged COVID-19 testing models that can be scaled and sustained to bridge critical disparities in COVID-19 testing uptake, as well as other public health or population health efforts.

Policies that have not unequivocally redressed historic and ongoing harm have threatened the success of COVID-19 testing programs—and broader public health interventions—in reaching marginalized and minoritized communities. Many perceptions and fears about COVID-19 testing result from an underlying distrust of the government as a steward of health and lived experiences due to structural racism and discrimination.[38,49] COVID-19 response efforts represent an opportunity for health leaders to strengthen partnerships with communities, policymakers, and health systems. With continued systemic exclusion, medical mistrust, discrimination, and racism in health care, health leaders can consider focusing on demonstrating trustworthiness across communities experiencing the greatest impact of COVID-19. Further, turning to public health models that engage communities, leverage cross-sector partners, and reduce regulatory burdens can support efforts to center equity. The framework we propose offers actionable-solutions to support and finance community-based strategies, which have the greatest potential to sustainably reduce health disparities and bridge health equity gaps today and in the future.

Appendix: Case Examples

Project 24: Developing A Realtime Monitoring System and Program to Improve COVID-19 Testing for Latinx Populations

Partners: Brown University, Progreso Latino

Project 24 combined quantitative (e.g., modeling and GIS mapping) and qualitative methods (e.g., focus groups and interviews) to contextualize and intervene on barriers related to COVID-19 testing among Latinx populations in Rhode Island. Project 24 worked collaboratively with Progreso Latino, the largest community organization in the state working to serve Rhode Island's Latinx and immigrant communities. Project 24 relied on community-engaged, data-driven approaches to identify, locate, and map systemic barriers to COVID-19 testing among Latinx populations. The team then operationalized their findings by developing implementation strategies and creating culturally competent tools to directly address identified barriers to COVID-19.

Leverage health information exchange (HIE) systems and develop pathways for cross-sector data sharing: HIEs enable the transfer of health data between all members of healthcare ecosystem. Rhode Island's HIE ("CurrentCare"), which is operated by the Rhode Island Quality Institute, supports access to health data anywhere care is delivered in Rhode Island (with patients' permission). This health information includes lab tests, details pertaining to hospital visits, medications, and any other health data needed to support treatment and management of patient care.[101] Project 24 used available HIE data to identify COVID-19 hotspots at the census track level. These data were used to study testing trends over time and identify "testing deserts" or areas with high positivity rates and low per capita testing sites/services. Interviewees noted that HIEs are very valuable assets for linking clinical data to public health and research.

Develop bi-directional communication platforms for community partners and members to share knowledge and expertise: Project 24 worked with their community partner, Progreso Latino, to implement a series of focus groups with Latinx populations from testing deserts, as well as additional interviews with providers from participating community health centers who have large populations of Latinx patients. The focus groups and interviews were designed to elicit the relevant barriers to COVID-19 testing and to identify approaches to improve access to testing. These groups also helped inform promotora outreach strategies and the subsequent development of communication tools to further bridge testing access gaps. The focus groups served as a platform for community members to engage in bidirectional conversations about the pandemic with the Rhode Island Department of Health. Progreso Latino convened the focus groups and handled day-to-day logistics, while Project 24 team members provided technical and infrastructure support. Interviewees noted that the focus groups were crucial for understanding the community-specific barriers to testing access and also helped provide a platform for community members to voice concerns, ask questions, and speak directly to relevant stakeholders associated with the pandemic response in Rhode Island.

Build infrastructure to support the community health workforce: The budget for this project was constructed to fully support the community organizations involved and foster opportunities for sustainable promotora engagement. For example, promotoras were employed on 2-year contracts, with the agreement that in the last 6 months of the contract the project would assist them with finding permanent employment. The promotoras worked as linkages between the community members and the health system partners, including three free clinics (Clínica Esperanza, Rhode Island Free Clinic, and Open Door Health) and three FQHCs (Providence Community Health Centers, Thundermist Health Centers, Blackstone Valley Community Health Center) in the state. Interviewees noted that promotoras helped in the "last quarter mile" by connecting community members with the health system through various engagement strategies. They also served as natural bridges for breaking down technical COVID-19 information into digestible formats for community members.

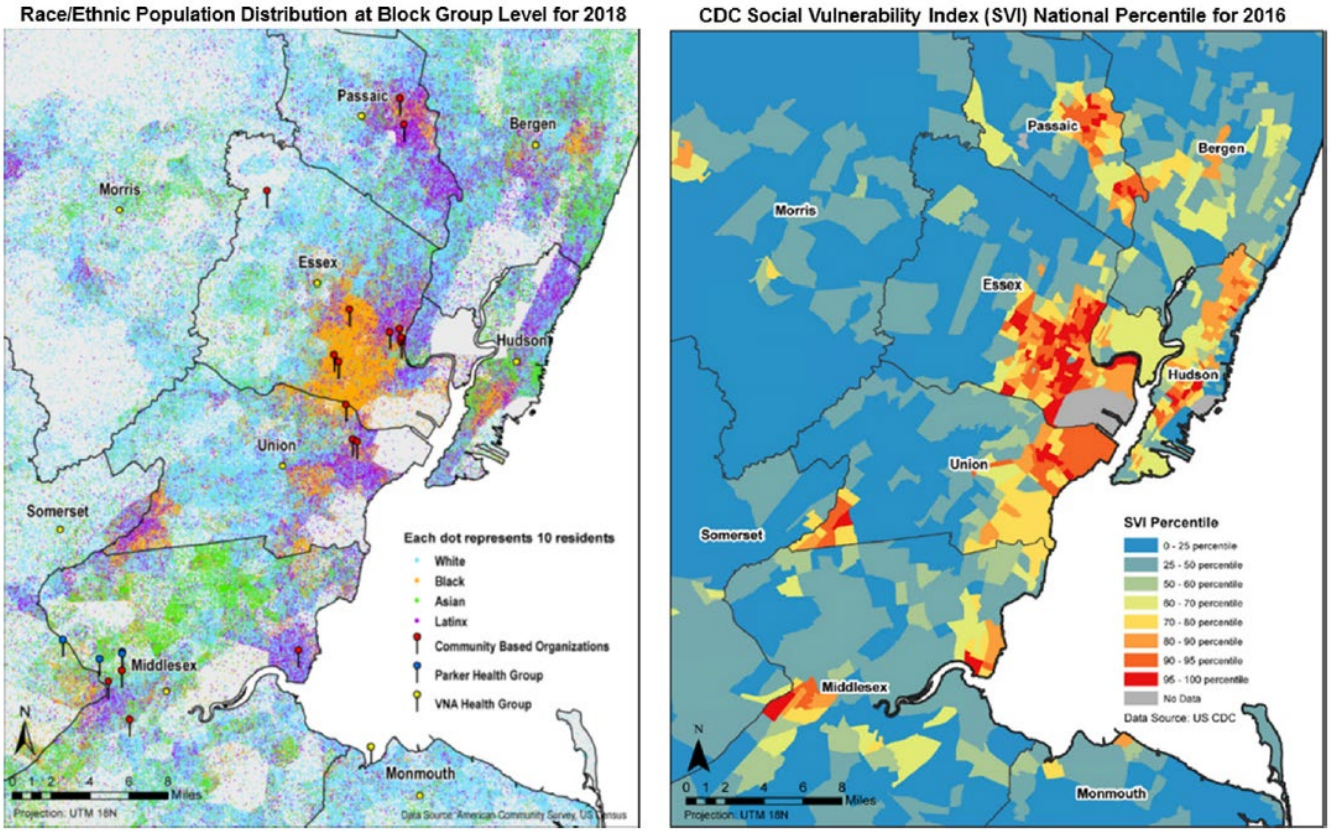
Project 37: New Jersey Healthcare Essential Worker Outreach and Education Study Testing Overlooked Occupation (NJ HEROES TOO)

Partners: ASPIRA Inc. of New Jersey; Central Jersey Family Health Consortium; Communities in Cooperation; East Orange Senior Volunteer Corporation; Health Coalition of Passaic County; Hillside Senior Recreation Center; Jazz4PCA; Mobile Family Success Center; New Brunswick Area Branch NAACP; New Brunswick Tomorrow; New Hope Baptist Church; Parker Health Group Inc.; Partnership for Maternal and Child Health of Northern New Jersey; Puerto Rican Action Board; Programs for Parents; Robert Wood Johnson University Hospital; Sister2Sister; The Bridge Inc.; United Way of Greater Union County; University Hospital Newark; Urban League of Union County Inc.; VNA Health Group

Project 37 tested different outreach strategies to implement noninvasive, home-based COVID-19 testing in low-income, Black, and Latino communities in four New Jersey counties (see below) exhibiting high social vulnerability. Specifically, they explored the impact of community-based outreach and compared it with a workplace-based outreach approach focused on lower-income health care workers, essential support staff, their households, and their broader social networks. Drawing from long-established relationships and community partners, the team engaged 16 community organizations in the design, development, and implementation of this project. Key strategies include:

Use data tools to identify communities experiencing the greatest impact of COVID-19: Project 37 used multiple data tools including GIS, COVID-19 case and mortality rates, and the social vulnerability index (SVI) to identify communities in which to focus their intervention (see Figure 2). This team identified community-based health care partners in counties with high COVID-19 case rates and exhibiting high social vulnerability: Essex, Passaic, Middlesex, and Union.

Figure 2: NJ HEROES TOO Counties of Focus displaying racial/ethnic density, poverty and coverage of health organization and community partners



Note: figure reproduced from Project 37's grant application.

Create open and bidirectional communication to engage communities effectively: Project 37 worked with community and health care organizations to host community conversations to gauge community attitudes about the pandemic and to better understand their resource needs. One important communication gap that became a recurrent theme as vaccines became increasingly available prior to the advent of the Omicron variant was the question of "Is testing relevant?" In response, Project 37 collaborated with community partners to host a series of virtual conversations in the format of town halls to bring in academic and non-academic experts to talk through the science of testing and communicate the benefits of testing and its importance. Through continued conversations about testing and the study findings as well as involving their partners as co-authors in knowledge creation, Project 37 leveraged existing trusted relationships and created new ones between their researchers, stakeholders, advocates, and partners.

Incorporate cross-sector partnerships to foster different perspectives: Project 37 began with a core of 16 partnered groups and expanded the breadth and scope of community partners by applying a snowball outreach technique to engage a total of 22 partners. The six-person interdisciplinary multiple principle investigator leadership team of Project 37 includes three publicly engaged researchers (a sociologist, a pediatrician, and an urban health educator) with expertise in community-engaged scholarship who have deep-rooted and longstanding relationships with both health care and community stakeholders and groups. They were joined by three cohort and clinical trial researchers (an epidemiologist, an immunologist, and a pulmonologist). Together, the team was able to leverage the strengths of their different disciplines and the expert knowledge of their citizen scientist stakeholder collaborators to think creatively about how best to engage the community in problem solving.

Use participatory and sustainable budgeting practices for all partners: Interviewees noted community partner engagement was a key strength of this project. Funding was allocated to support knowledge co-creation (i.e., understanding the core concerns and creating messaging and media content that addressed those concerns). Each partner was included in the project budget. Community partners were given flexibility to use their funding to best serve their individual constituents. Additional funding supported a media consulting group who helped to develop a unified dissemination platform. Interviewees expressed that future public health policies should be designed to support longitudinal community engagement and management and build resilience in communities.

Project 48: Adapting Community-Based Task-Shifting for the COVID-19 Response Among Underserved Populations in Piedmont, North Carolina (ACT-UP)

Partners: University of North Carolina at Chapel Hill, Hispanic Liaison, Piedmont Health Services, General Baptist State Convention of North Carolina

Project 48 is focused on community-based task shifting and partnerships with trained non-clinical health workers. The team also supports Piedmont Health Services, a network of Federally Qualified Health Centers (FQHCs), to provide COVID-19 testing and vaccination services to communities. This model adapts a proven implementation strategy from the global HIV response to disseminate COVID-19 information and reach communities with COVID-19 testing and vaccine services.[102] Key strategies include:

Fill operational gaps with strategic partnerships and coalition-building: Often, community-based organizations lack the resources and infrastructure to run testing clinics while health providers fail to meaningfully engage communities historically excluded and impacted by structural disadvantages in the health care system. Project 48 has bridged clinical expertise and logistical infrastructure by building a coalition of partners to provide health education and conduct outreach, testing, and vaccination. Piedmont Health and state and local health departments implemented testing (and later vaccination) clinics while working with community partners such as Hispanic Liaison, SER Hispano, and faith-based organizations such as those within the General Baptist State Convention of North Carolina. The cross-sector partnerships provided community partners with operational support to bring health care services to people and data to prioritize and plan innovative interventions.

Allocate funding resources specifically for CHWs to overcome anticipated and pre-existing staffing constraints: Project 48 has provided operational support to bring health care services to people and data to prioritize and plan innovative interventions. Specifically, Project 48 included funding for staff at Piedmont Health, including CHWs and leadership staff who could specifically focus on COVID-19 services, to facilitate task shifting and task sharing across the team.

Connect health services to the population through community liaisons: Faith-based organizations and advocacy groups (e.g., Hispanic Liaison) helped remove barriers between the community and health system that make accessing health care inconvenient, costly, and complicated. For example, Hispanic Liaison worked with community members to set up testing appointments and eliminated complicated technology and language barriers posed by lengthy online registration sites. Instead, Hispanic Liaison connected with community members over the phone and in person to fill out registration forms on their behalf.

Develop protocols that are amendable to real-time changes and challenges: In late September 2021, Project 48 recognized a new challenge to the vaccination process – people were misplacing or losing their vaccination cards. To solve this problem, project leaders developed a communication process to remind people of the importance of (and provide strategies for) keeping their vaccine cards safe. The communications team created flyers (available online and in print) in Spanish and English for health care providers and trusted community partners to remind people what to do after vaccination and how to store their cards.

Project 56: Alive Church Network: Increasing COVID-19 Testing in Chicago's African American Testing Deserts

Partners: Rush University Medical Center, University of Illinois Chicago, Alive Church Network, Hope Community Church, Greater Rock MB Church, Cook County Department of Public Health

Project 56 worked with local churches to establish COVID-19 testing sites in Black communities in Chicago that have experienced limited testing availability, contributing to racial disparities in health outcomes from the outset of the pandemic.[103] Project 56 focused on outreach and information sharing to overcome challenges related to misinformation and rapidly changing COVID-19 guidance. Key strategies include:

Partner with established community organizations, including churches, to select community-based testing sites: Project 56 partnered with church pastors and teams of community members to create the necessary infrastructure to provide accessible testing. Churches also offered physical locations for testing sites to be housed in areas with high COVID-19 positivity rates. As COVID-19 vaccines became available, these church-based testing sites also became important vaccine distribution locations. Some community members reported only getting vaccinated because their churches and trusted community organizations were promoting and providing the vaccine.

Co-locate public health interventions with other community services and events: Testing efforts were more successful at locations that provided other social supports and community services such as food assistance and financial aid. Examples of sites included back-to-school events and youth baseball league games in the Park District.

Address CHW shortages through long-term employment models: Although funding for testing sites was made available, the pandemic resulted in staffing shortages. To establish and retain long-term community relationships, Rush University Medical Center hired CHWs directly as employees, rather than contracting on a month-to-month basis. This funding strategy helped ensure the availability

of team members to keep church-based testing and vaccination sites open, as well as facilitate trust and open communication with community members. Future public health community interventions should likewise create sustainable payment models to prevent health care staffing shortages during periods of emergency or increased health care demand.

Allocate research and implementation funding to maintain community partner relationships: Interviewees from Project 56 noted the collaborative team of clinicians, CHWs, and community partners as a key success factor. RADx-UP funding allowed Project 56 to establish an academic-community partnership based on existing networks within the community they serve.

Project 62: Social, Ethical, and Behavioral Implications Research on COVID-19 Testing and Vaccine Uptake among Rural Latino Migrants in Southwest Florida

Partners: Hispanic Services Council, University of South Florida Latino Alliance, Local FQHCs

Project 62 aims to develop and implement integrated community-based prevention marketing strategies, informed by community members' perspectives, to promote uptake of COVID-19 testing and vaccination. In collaboration with their community partner the Hispanic Services Council (HSC), Project 62 focused on engaging rural Latinx migrant and immigrant communities in southwest Florida to elicit community perceptions of COVID-19 as well as feedback on culturally tailored marketing and education approaches. Key strategies include:

Provide adequate funding for community partners: Given that many community-based organizations are often underfunded and resource-constrained, Project 62 designed its grant structure to provide funding directly to the HSC to use as needed for the project. Adequate funding was achieved in part by RADx-UP's encouragement of equal partnerships between academic institutions and community organizations. As a result, the HSC was afforded a stable budget for their involvement in Project 62 that allowed them to assume a lead role in study activities and hire local study staff. For example, the HSC led community workshops and presentations, contributed to survey question development, co-authored conference abstracts, and are co-authoring manuscripts that are in progress. Interviewees felt the equitable collaboration between the HSC and the University of South Florida (USF) increased the richness of their research project.

Invest in local CHWs: The HSC provides health education and community support to over 5000 Latinx community members through their *promotora* program. Promotoras from local rural Latinx communities identified by Project 62 were key to enrolling and engaging participants in focus group discussions and surveys. Interviewees noted difficulty recruiting and retaining promotoras due to issues related to COVID-19, compensation, and lack of benefits with part-time positions; however, the HSC's dedication to the professional development of promotoras helped to overcome these issues. For instance, HSC helped promotoras revise their resumes and provided training certificates (e.g., Collaborative Institutional Training Initiative certification) that could help them obtain future work.

Develop and implement communication strategies in collaboration with communities: Using findings from their focus groups and surveys, Project 62 will collaboratively (HSC Director, USF marketing and research investigators, and promotoras) develop integrated marketing strategies to produce culturally tailored communication materials, media campaigns, and HSC community-based programs to increase COVID-19 testing and vaccine uptake. To illustrate this, interviewees described how preliminary analyses of survey data are helping them to determine ways to frame COVID-19 messaging and groups to direct resources and services. Feedback on the formulated social marketing products will be obtained through group *charlas*, or community discussion groups facilitated by promotoras and USF research staff.

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Disclosures

The authors have no financial interests related to testing or other content included in this report to disclose.

About the RADx® Underserved Populations Coordination and Data Collection Center (RADx-UP CDCC)

The RADx-UP Coordination and Data Collection Center (CDCC) is the central leadership and support team assisting the NIH and these projects as they serve their communities. The CDCC, led by The Duke Clinical Research Institute (DCRI) and UNC Center for Health Equity Research (CHER), oversees the RADx-UP program and its funding awards to more than 125 research teams across the United States and its territories as well as Tribal Nations. Providing organizational and analytical infrastructure and expertise for the program, the CDCC supports data integration, analysis, and coordination across RADx-UP projects and helps synthesize evidence on new COVID-19 testing strategies and technologies. The CDCC is organized into four core support teams: the COVID-19 Testing Core; the Community engagement Core, the Data Science and Biostatistics Core; and the Administrative Core. For more information, visit https://radx-up.org/about/coordination-center/.

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Part of the Duke University School of Medicine, DCRI is the world's largest academic clinical research organization. They conduct innovative research to deliver on their mission to share knowledge that improves the care of patients around the world. DCRI projects are led by physician scientists whose grounding in patient care helps to inform their research, and supported by staff who have deep expertise in operationalizing global studies. For more information, visit dcri.org.

About the UNC Center for Health Equity Research (CHER)

Part of the UNC School of Medicine, CHER brings together collaborative, multidisciplinary teams of stakeholders to improve health in North Carolina communities, with a shared commitment to innovation, collaboration, and health equity. This shared commitment serves as a bridge among their disciplines and levels of experience. CHER members generate new knowledge and contribute to the science of health equity research and implementations, thus driving innovation in collaboration with communities to improve well-being. For more information, visit med.unc.edu/cher.

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