Evaluating the efficacy of a nurse-community health worker-family partnership intervention in promoting COVID-19 testing uptake in an underserved community: a study protocol for a randomized control trial

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Abstract

Background: The impact of COVID-19 has been unequal across the nation in regards to number of cases, hospitalizations and deaths. Notably, primary strategies employed for COVID-19 mitigation at the national, state, and local levels (i.e. COVID-19 testing, vaccination rollouts, etc) often have inadequate reach in communities that experience COVID-19 disparities. Therefore, new approaches for COVID-19 mitigation are needed to more effectively reduce disparities. The current trial tests a novel approach by evaluating the efficacy of the Nurse-Community-Family Partnership (NCFP) intervention to improve primary (COVID-19 testing uptake) and secondary (COVID-19 vaccine uptake, adoption of COVID-19 infection control measures, household mutual aid capacity, and seasonal influenza vaccine uptake) outcomes in a community experiencing disproportionate COVID-19 morbidity, mortality, and barriers to mitigation.

Methods: In this two-arm parallel randomized control trial, we will evaluate the efficacy of the NCFP intervention in improving the primary and secondary outcomes. We will recruit 150 households from the Bronx in New York City. These households will be randomized in a 2:1 ratio, intervention:control, using a computer-generated algorithm. The NCFP intervention will take place over 5 months. The core components of the intervention include regular home visits by nurses and community health workers, development of a household-specific infection control plan, offer of at-home COVID-19 tests, and navigation to COVID-19 vaccination and other ancillary services. NCFP intervention components and intensity is informed by a household risk algorithm (low, medium, high). All households will complete a baseline assessment, monthly follow-up surveys during months 1-6 post baseline, and a delayed 9-month follow-up survey. We will use intent-to-treat analysis to evaluate the efficacy of the intervention in improving the primary and secondary outcomes compared to the standard of services. Subgroup analyses based on select household characteristics will be conducted.

Discussion: The NCFP intervention may have utility for mitigating COVID-19 at the household level—a novel and promising approach. If the trial achieves this, this care delivery model relying on a partnership between nurses, community health workers, and families will expand the available cadre of effective strategies for COVID-19 mitigation in underserved communities.

Trial registration: ClinicalTrials.gov NCT04832919. Registered on April 6th, 2021.

Keywords

COVID-19, nurse-driven models of care, household intervention, testing, randomized control trial

Administrative Information

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Data Sharing Statement: The project team will share all individual participant data that underlie the results reported in any future published manuscript, after deidentification (text, tables, figures, and appendices). The project team will make the data available beginning 3 months and ending 5 years following article publication for investigators whose proposed use of the data has been approved by an independent review committee to conduct analyses to achieve the aims in their proposal. Proposals should be directed to Dr. Holly Hagan (hh50@nyu.edu). To gain access, data requesters will need to sign a data access agreement.

Introduction

Background and rationale {6a}

Despite concerted efforts at the global, national, and local levels to mitigate the impact of COVID-19, the pandemic continues to inflict far-reaching health, socioeconomic, and political repercussions globally. In the US alone, the COVID-19 pandemic produced devastating health consequences with more than 80 million cases and 990,000 confirmed or probable deaths due to COVID-19 [1]. However, the impact of COVID-19 in the US has been unequal, with some communities experiencing substantially higher rates of COVID-19 cases, hospitalizations, and deaths. The disparities found in morbidity and mortality are driven by differences in exposure and susceptibility to COVID-19 across communities, with the greatest observed COVID-19 disparities occurring in communities where both elevated exposure and susceptibility exist [2]. Numerous community-level factors are associated with greater risk of exposure to COVID-19. For example, communities with large proportions of front-line workers who are in frequent face-to-face contact, heavily rely on public transportation, and live in crowded households located in densely populated areas are at a higher risk of exposure to COVID-19 [3]. Similarly, community-level factors can increase susceptibility to severe COVID-19 among those who are exposed. For example, communities that face poor access to timely health care, poor quality of care, and pre-existing health conditions are more biologically susceptible to COVID-19 morbidity and mortality [4-10]. In the US, residents in structurally underserved communities with elevated exposure and susceptibility to COVID-19 are disproportionately people of color and families with household incomes below the national average. As a result, there are pronounced disparities in COVID-19 cases, hospitalizations, and deaths along the lines of race/ethnicity and socioeconomic status are reflected in national data [4-10].

COVID-19 testing is one of the most important measures the global community has adopted to help mitigate the spread of the virus. Previous research demonstrates that testing was vital to slow the rate of transmission when undetected cases were widespread. Testing is also crucial in mitigating local spikes

and newly emerging waves of COVID-19. For example, a recent study showed college campuses across the US reduced the number of infection cases by 96% after imposing routine diagnostic tests of asymptomatic students [11]. Furthermore, early detection allows individuals to seek treatment before the illness progresses in severity and optimize their chances of survival. The importance of availability and uptake of testing for early detection of COVID-19 is particularly salient in the context of innovative antiviral medications (Sotrovimab, Nirmatrelvir-Ritonavir, Remdesivir, and Molnupiravir) that are currently available, and for which effectiveness appears higher early in the disease cycle [12]. According to Phase 2/3 results of the EPIC-HR study, the Nirmatrelvir-Ritonavir pill significantly decreased the risk of hospitalization or death by 89% for those who took the pill within the first few days of experiencing symptoms [12].

While the significance of COVID-19 testing is well-documented, existing barriers prevent communities who need it the most from receiving it. For instance, long wait-times, sparse testing locations, fear of contracting the virus at testing sites, and language barriers were among a few of the concerns voiced by these underserved communities [13]. Additionally, undocumented and/or uninsured individuals face more challenges when testing sites impose restrictions to receive free COVID-19 tests. This highlights the growing need for new approaches to expand testing availability for all, particularly in communities with elevated risk of exposure and susceptibility to COVID-19.

Throughout the COVID-19 pandemic, healthcare facilities helped increase testing rates by offering walk-in appointments, setting up drive-through sites, and sending out in-home testing kits [14]. While these strategies provide numerous options for individuals to get tested, it places the burden of seeking them out on the individual. Moreover, these options only accommodate those with their own means of transportation or those who can afford the high costs of at-home COVID-19 test kits. As a result, COVID-19 testing rates are disproportionately lower in underserved communities. Underserved communities that face structural barriers to COVID-19 testing tend to disproportionately make-up people of color. For instance, a study found that testing rates decreased as the percentage of ethnic-minority

residents residing in a New York City (NYC) neighborhood increased during the months of March and April of 2020 [15]. Existing evidence from health service delivery targeting other conditions suggests, nurse-driven approaches have utility for addressing these gaps. For example, an approach used regular in-home visits by nurses to successfully improve parental care and maternal life course in low-income families [16]. This method of by tailoring service delivery to the unique contexts of underserviced communities presents an opportunity to improve reach of services and improve outcomes [16]. The implications of previous studies that use this strategy suggest similar nurse-driven approaches have the potential to address the challenges associated with COVID-19 testing.

The current randomized control trial (RCT) tests the efficacy of a new intervention that draws from previous nurse-driven approaches, the Nurse-Community-Family Partnership (NCFP) program. Similar to existing nurse-driven approaches, the program consists of regular in-home visits by nurses and community health workers. These nurses will employ a range of infection control measures, such as frequent in-home COVID-19 testing. They will also work with families to create and monitor the practice of an infection control plan uniquely tailored to the household's needs. Furthermore, community health workers will provide culturally appropriate support to the families, address stigma, medical mistrust, and help direct household members to a range of relevant services. This trial will be implemented in a sub-community in the US that pose at a greater risk to exposure and susceptibility of COVID-19: NYCHA households in Mott Haven, a neighborhood located in the Bronx, NYC. This intervention is designed to increase COVID-19 screenings and access to results as a way to improve these health outcomes. The overarching goal of this project is to inform current and future initiatives related to COVID-19 mitigation in similar socioeconomically underserved communities and households of color.

Objectives {7}

The objectives of the study are to evaluate the efficacy of the Nurse-Community Health Worker-Family Partnership intervention to:

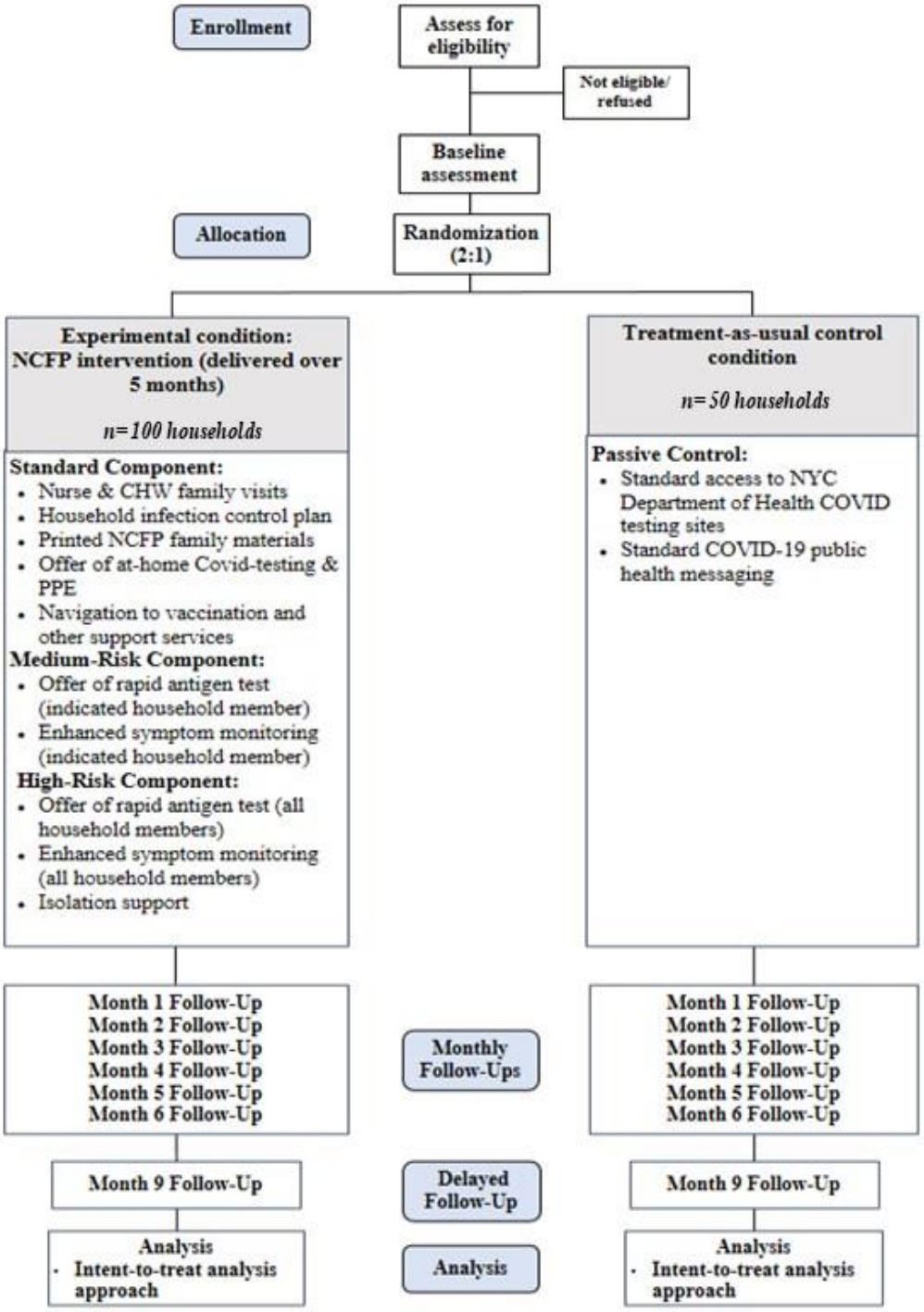
a. Improve uptake of household COVID-19 testing

b. Increase adoption of COVID-19 control measures as defined by:
    i. Use of personal protective equipment (PPE)
    ii. Frequent use of hand disinfectant and handwashing
    iii. Maintenance of social distance
c. Increase vaccine uptake
d. Improve household-level mutual aid capacity as defined by family resiliency to secondary sequelae (psychological distress, financial insecurity, housing and food insecurity, job instability, substance abuse, and sexual behavior) and family cohesiveness.

Trial design {8}

This intervention study is a parallel, assessor-blind, randomized control trial. 150 households from public housing developments in the South Bronx, New York City, will be enrolled and randomized in a 2:1 ratio, intervention:control. Households will be randomly assigned to either the NCFP intervention group ($n = 100$) or the treatment-as-usual control group ($n = 150$). The unit of random assignment and intervention delivery will be the household; however, the primary and secondary outcomes will be measured and analyzed at the individual household member-level. The study hypothesis is that the NCFP intervention will be superior to the standard level of care in improving the primary (household-level COVID-19 testing uptake) and secondary (adoption of COVID-19 control measures, household-level mutual aid capacity, household-level COVID-19 vaccine uptake and seasonal influenza vaccine uptake) outcomes. The study consists of a baseline assessment, a 5-month intervention period, monthly follow-up assessments during months 1-6 and a delayed follow-up assessment at 9 months post-baseline. The study is registered with ClinicalTrials.gov (NCT04832919). A CONSORT flow diagram of the study is shown in Fig. 1.

Figure 1. CONSORT flow diagram



Methods: Participants, interventions and outcomes

Study setting {9}

Since the start of the pandemic, the Bronx has had the highest rate of COVID-19 cases (140 per 1000), deaths (4.7 per 1000) and the lowest rate of COVID-19 testing per capita (35 per 1000) compared to other boroughs [1]. Many of the health and economic inequities that characterize the Bronx have made it difficult to combat these outcomes. Households will be recruited from public housing developments in Mott Haven, a neighborhood located in the South Bronx, New York City. Eleven buildings located in this neighborhood will be the catchment area for recruitment.

Eligibility criteria {10}

Inclusion Criteria:

- Residence in one of the public housing complexes in Mott Haven, South Bronx
- English or Spanish-speaking
- Age 10 years or older
- Willing and able to provide informed consent or assent

Exclusion Criteria:

- Non-resident of one of the public housing complexes in Mott Haven, South Bronx
- Neither English nor Spanish speaker
- Younger than 10 years old
- Unwilling or unable to provide informed consent or assent

Who will take informed consent? {26a}

A study staff member trained in human subjects protection will explain all study components, screen for eligibility, and obtain informed consent/assent from the participants. Participants who are 18 years or older will provide consent for themselves. Participants who are younger than 18 years will provide assent for themselves and their parent or legal guardian will provide consent for their child's participation as

well. All eligible participants must provide written consent/assent prior to enrollment and randomization to one of the study arms. During the consent process, the study staff member will emphasize the measures that will be taken to ensure confidentiality is not breached, including the use of encryption software to protect any identifiers.

Compensation:

Participants will receive a gift card after the completion of each survey (at baseline as well as monthly during months 1-6 and at 9 months post-baseline). This will total to an amount of $270 United States Dollar (USD) in gift card value.

Additional consent provisions for collection and use of participant data and biological specimens {26b}

Participants will be informed that all assessments and COVID-19 test results will be de-identified. Participant names will be replaced with a unique identification number, which only research staff have access to. Additionally, the consent forms explain how saliva/nasal swab samples may be collected for COVID-19 testing use from enrolled participants in the intervention arm. Only identified positive COVID-19 test results will be reported by name to the NYC Department of Health as part of the NYC COVID-19 test reporting protocol. This research is covered by a Certificate of Confidentiality from the National Institutes of Health (NIH); therefore, the research personnel will not disclose or use information that may reveal participants' names to any federal, state or local civil, criminal, administrative, legislative, or other action, suit, or proceeding, even if a court subpoena is issued. After the study is terminated, participants' data may be used for future research or stored in a data repository without obtaining additional consent.

Interventions

Explanation for the choice of comparators {6b}

This 2-arm randomized control trial will compare the efficacy of standard, publicly available COVID-19 testing and messaging to a Nurse-Community-Family Partnership intervention. The investigators

hypothesize that the NCFP intervention will improve household-level COVID-19 testing, COVID-19 vaccine and seasonal influenza vaccine uptake, adoption of COVID-19 infection control measures, and mutual aid capacity for households in the experimental group compared to the standard of care control group.

Intervention description {11a}

Experimental condition

The NCFP intervention is delivered by nurses and community health workers (CHWs) as part of a collaborative partnership with households over the course of 5 months. On average, there will be three nurse-CHW home visits to households randomized to the intervention condition per month. Each visit will last for approximately 45 minutes on average.

The NCFP intervention prioritizes provision of intervention content based on three household risk levels: low, medium, and high. This intervention will use an algorithm to determine household-level risk to COVID-19. Low risk is defined by experience of no symptoms and no exposures by all household members. Medium risk is defined by experience of either symptoms (i.e. new cough, chest pain, fever above 100.4°, and/or loss of taste or smell) or an exposure to someone with known or suspected COVID-19 by any household member. High risk is established when a household member has a confirmed positive COVID-19 test. The algorithm will be informed by self-report of symptoms and exposures through a nurse hotline that is available for households placed in the intervention arm to use. Additionally, nurses will conduct weekly phone screenings to continue monitoring household symptoms and exposures. For households that are at low risk, the intervention delivery team will provide the standard intervention content, which consists of (1) development and follow-up of an infection control plan tailored to the unique circumstances of the household, (2) printed NCFP family materials, (3) offer of monthly routine Polymerase Chain Reaction (PCR) COVID-19 test (self-administered saliva test), (4) provision of PPE (masks, hand sanitizer, gloves) and a thermometer, and (5) navigation to at-home or community-based COVID-19 vaccination services, as well as health, social welfare, vocational,

economic, or other support services as needed. For households that are at medium risk, in addition to the standard intervention content, the intervention delivery team will offer a rapid antigen COVID-19 tests to household members who are experiencing symptoms or were exposed and conduct enhanced symptom monitoring (daily phone screenings of new or worsening symptoms for seven days after report of symptoms or exposure). For households that are at high risk, nurses will additionally offer rapid antigen tests to all household members, enhanced symptom monitoring with all household members, and provide isolation support and guidance. In the event household members display any other acute emergency, nurses and CHWs will coordinate with the clinical triage team, where they will conduct triage, medical case management, monitoring, referrals to care, and follow-up.

In this intervention, nurses will supervise CHWs. Nurses will work with households on clinical and technical COVID-19 related issues, as well as build knowledge and skills that will help mitigate the spread and development of COVID-19 symptoms in households. For instance, nurses will offer routine in-home COVID-19 testing to all members of the household and deliver training on household infection control skills, including the safe and correct use of PPE, frequent use of hand disinfectant and handwashing, and social distancing techniques. The CHWs will serve as a culturally appropriate resource for families randomized to the intervention condition to ensure continued engagement and retention in the Nurse-Community-Family Partnership. CHWs will work with households to address expectancies, norms, and emotions that may represent barriers to COVID-19 testing and other related services. Additionally, CHWs will provide navigation to support services as needed.

Treatment-as-usual condition

Control participants will be informed of free COVID-19 testing, COVID-19 vaccination, and influenza vaccination sites located in the community and provided with the current NYC Department of Health standard COVID-19 information.

Criteria for discontinuing or modifying allocated interventions {11b}

No plans to discontinue interventions. Intervention messages may be modified in accordance with changing scientific evidence on COVID-19, COVID-19 mitigation, and Centers for Disease Control and Prevention (CDC) guidance.

Strategies to improve adherence to interventions {11c}

There will be flexibility in scheduling NCFP visits (including on weekends), a reminder call to households before each scheduled visit to confirm, and reminders materials to highlight the importance of calling the nurse hotline in case of symptoms or exposure (e.g., a refrigerator magnet).

Relevant concomitant care permitted or prohibited during the trial {11d}

There will be no restrictions imposed.

Provisions for post-trial care {30}

At the end of the intervention phase, all households will receive information on available testing and vaccination sites in the community.

Outcomes {12}

The primary outcome of interest is the following:

1. Household COVID-19 testing

Household COVID-19 testing uptake at the 9-month follow-up (9MFU) with be the primary outcome of interest. Our project will document testing uptake that is either administered by nurses or self-administered during home visits in the experimental arm, as well as self-reported information regarding COVID-19 testing uptake by study participants in the treatment and control groups. Participants will be asked whether they have received COVID-19 testing in the past three months, as well as about variables collected via the COVID-19 Symptoms, Diagnoses, and Testing scale. The COVID-19 Symptoms, Diagnoses, and Testing scale is adapted from the COVID-19 Cannabis Health Questionnaire. Specifically, participants will be asked questions regarding whether they are currently sick with an illness that might be related to COVID-19, any symptoms the participant experienced in the past three months, and the result of the participant's last COVID-19 test.

The secondary outcomes of interest are:

1. Household COVID-19 Testing Uptake

All medical services delivered by nurses during home-visits (such as COVID-19 test administration) will be carefully documented by the investigative team. At the time of the 6-month-follow-up (6MFU) assessment, the project team will obtain self-reported information regarding COVID-19 testing uptake by study participants in the treatment and control groups. Respondents will be asked whether they have received COVID-19 testing in the past six months. Respondents will also be asked questions from the COVID-19 Symptoms, Diagnoses, and Testing scale regarding whether they are currently sick with an illness that might be related to COVID-19, any symptoms the participant experienced in the past six months, and the result of the participant's last COVID-19 test.

2. COVID-19 control measure uptake

COVID-19 control measure uptake will be assessed using the COVID-19 Knowledge, Attitudes, and Avoidant Behaviors section of the Understanding America Study. Respondents will be asked questions on a 5-point Likert scale (Almost Never to Always), with higher values representing greater uptake of COVID-19 prevention behaviors (e.g., "Had close contact (within 6 feet) with people who do not live with you. "Gone out to a bar, club, or other place where people gather) and COVID-19 control uptake (e.g., "Worn a mask or other face covering." "Washed your hands with soap or used hand sanitizer several times per day"). COVID-19 control measure uptake will be assessed at the immediate follow-up (6 months) and at the delayed follow-up (9 months).

3. Vaccine Uptake

The investigators will obtain self-reported information and documentation of influenza and COVID vaccine uptake by study participants at the 6-month and 9-month follow-up assessments. Respondents will be asked if they received the flu shot [Yes/No] and whether they received the COVID-19 vaccine [Yes/No], the type of vaccine, and the number of doses.

4. Household mutual aid capacity

A set of measures will assess household mutual aid capacity, defined by the overall impact of COVID-19 on food and housing insecurity, substance use, sexual behavior, psychological distress, and family dynamics and relationships.

Participant timeline {13}

STUDY PERIOD										
	Enrolment	Allocation	Post-allocation							Close-out
TIMEPOINT**	***Month 0***	***Month 0***	***Baseline***	***Month 1***	***Month 2***	***Month 3***	***Month 4***	***Month 5***	***Month 6***	***Month 9***
ENROLLMENT:										
Eligibility screen	X									
Informed consent	X									
Allocation		X								
INTERVENTIONS:										
Nurse-Community Health Worker-Family Partnership				←	—	—	—	→		
Treatment-as-usual				←	—	—	—	→		
ASSESSMENTS:										
COVID-19 Symptoms, Diagnoses, and Testing Scale (PhenX Toolkit)			X	X	X	X	X	X	X	X
COVID-19 Avoidant Behaviors Scale (PhenX Toolkit)			X	X	X	X	X	X	X	X
COVID-19 Household Environment Scale			X	X	X	X	X	X	X	X
Self-Reported Vaccine Uptake			X	X	X	X	X	X	X	X

Sample size {14}

Power for the proposed study was calculated using Power Analysis and Sample Size software based on household level randomization, individual level outcomes using conservative estimates and adjusting for 15% attrition and allowing for subgroup analyses. A test for the difference in two proportions using a mixed model based on a clustered 3-Level Hierarchical Design with level-3 (household) 2:1 intervention: control randomization. The total sample size of 300, obtained from 100 level-3 units (households) in the intervention group and 50 level-3 units in the control group with an average of 2 level-2 units (individuals) per level-3 unit (household) and an average of 3 level-1 units (timepoints) per level-2 unit (individual), achieves >80% power to detect a difference between the group proportions of at least 0.15. The proportion in group 2 is 0.10. The correlation of level-1 units within a level-2 unit is <0.7. The correlation of level-2 units within a level-3 unit is <0.3. A test based on a mixed-effects logistic regression is anticipated at a significance level of 0.05.

Recruitment {15}

Recruitment from randomly selected households will begin with canvassing, when flyers will be placed in the building announcing the study. Study staff will talk to residents in the lobbies and courtyards about the opportunity to participate. Once study staff have adequately established their presence, the study recruitment team will move forward with door-to-door recruitment of randomly selected households. Once potential participants open their front door, the recruitment team will take the opportunity to explain the study. For interested households, the recruitment team will administer a screening questionnaire to assess their initial eligibility. If households are eligible and interested to enroll into the study, they will move forward to the consent process.

Assignment of interventions: allocation

Sequence generation {16a}

The allocation sequence will be generated using a computer algorithm prior to the begin of study enrolment.

Concealment mechanism {16b}

The allocation sequence will be coded into REDCap where it will only be visible to the REDCap data management team.

Implementation {16c}

Households that are enrolled into the study will be entered into the REDCap database, which automatically assigns a study ID. REDCap assigns the household study ID to either the experimental or control condition using the pre-generated and coded sequence. After completion of the baseline assessment (assessors are blinded), the REDCap data manager notifies the NCFP intervention team of new households that have been assigned to the experimental condition. The intervention team then contacts the household to begin the NCFP intervention program.

Assignment of interventions: Blinding

Who will be blinded {17a}

The statistician and physicians that comprise the Data Safety Monitoring Board (DSMB) will be blinded to the allocation. Additionally, all study staff members who are involved with scheduling, coordinating, and implementing data collection will be blinded to the allocation (assessor blinded).

Procedure for unblinding if needed {17b}

In this trial, participants will be aware of the study condition they were assigned to. As such, procedures for unblinding will not be needed.

Data collection and management

Plans for assessment and collection of outcomes {18a}

Data will be collected at eight time-points: baseline, monthly during months 1-6 of the study, and at 9 months post-baseline. Participants will complete self-reported surveys that assess basic demographics such as birthdate, age, gender, race/ethnicity, educational attainment, etc. In addition to collecting basic demographics, the study surveys will contain items and scales from the PhenX Toolkit and the NIH Disaster Response website. These survey items and scales will assess participants' household-level

COVID-19 routine testing, household-level COVID-19 indicated testing, COVID-19 vaccine uptake, adoption of COVID-19 control measures, household-level mutual aid capacity, and seasonal influenza vaccine uptake. All survey items developed by our team will be shared with the Rapid Acceleration of Diagnostics Underserved Populations (RADx-UP) Coordination and Data Collection Center and made public. Data will be collected via tablets that will be programmed in REDCap. Surveys are available in English and Spanish to facilitate, survey data collection. The survey may be self-administered or, in the case of low literacy or lack of familiarity with electronic devices, data collection staff will read prompts and record survey responses onto the tablets. Mode of administration will be recorded for later analysis of potential bias. To reduce social desirability bias, CHWs and nurses who deliver the NCFP intervention will not take part in the data collection process. Rather, data collection will be conducted by dedicated staff who are trained in survey research methods and human subject protections, including confidentiality. Additionally, social desirability tendency will be assessed using designated items in the study surveys. Furthermore, we will record participation rates for each household by member.

Plans to promote participant retention and complete follow-up {18b}

During the consent process, the study team will obtain extensive tracking information, including phone numbers, email addresses, and home addresses. Participants will be asked to provide contact information for three people who know how to reach them in most circumstances. These methods were used in previous work in the South Bronx with an attrition rate of 8% over 12 months [17]. Prior experience indicates that virtually all respondents will have a cell phone or access to a phone. However, as part of the consent process, we will obtain permission to revisit the home to make follow-up appointments if phone contact is not possible. Additionally, we will allow for flexibility in scheduling by conducting reminder calls before scheduled data collection appointments.

Data management {19}

In accordance with the NIH requirements, the clinical trial created a data and safety monitoring plan to protect participants' privacy and confidentiality during the study. A DSMB will be established and be in

direct communication with the relevant program officer at NIH. The DSMB will be comprised of at least 4 individuals (with a designated committee chair), who represent expertise in bioethics, statistics/ methodology, medical testing, vaccinations, and research knowledge in COVID-19 and infection control.

Data will be collected by trained and supervised staff members on tablets that are programmed in REDCap. Access to the project's offices are restricted to faculty and staff. The building is secure and monitored by security staff. File drawers containing participant information are kept locked when not in use. Only project staff members have keys to these file cabinets. Only the consent forms, locator forms, and computerized tracking database link the participant's name to the identification number. The computerized tracking database is kept on a password-protected folder on the NYU server, which requires a separate password to be accessed. Staff who are not members of the research team for this study do not have access to this folder. All computerized data (survey data, transcripts, and biological specimen results) are kept on computers that are double-password protected and files are only labeled with participant identification numbers. Files are sent to the NYU share drive for back-up, which is also double password protected and available only to project staff. A master database that contains participant identifying information and participant identification (PID) numbers is kept on the internal NYU share drive. This folder is double password protected and can only be accessed by the study's staff members.

Confidentiality {27}

To protect the integrity of the participants' data, the following procedures will be followed. First, all participants enrolled in the study are assigned a random code number. This code number is used on all information collected from participants, including consent forms, surveys, and biological specimen results. Participants will never be identified by name on consent forms, surveys, and biological specimens. No other information that would disclose the participant's identity will be found on any assessment or notes. We will maintain a list of participants with links between identifying information and code numbers. Only the Investigative Team will have access to these lists, which are kept in on a password protected computer system. All data will be stored in locked files or on password protected

computers in the Principal Investigators' and project statistician's offices. As part of the informed consent process, participants will also be informed that all information they provide in interviews is confidential with the following exceptions: (1) If they are in imminent danger of committing suicide or homicide, the appropriate local agency will be contacted and (2) if they are physically or sexually abusing someone, the appropriate local agency will be contacted.

All project staff must complete certain levels of training before working on the project. Study staff also sign confidentiality statements that specify that if the participants' confidentiality is breached unintentionally, then study staff members will follow the procedures for reporting this breach to the Principal Investigators. The confidentiality statement also states that unintentional or deliberate violations of participants' confidentiality may result in demotion or termination depending upon the severity of the event. Personnel also participate in training with the Investigative Team regarding data safety, confidentiality of participants, limits of confidentiality, and proper administration of the study protocol. We estimate that 40 hours of training will be completed by all project staff.

Plans for collection, laboratory evaluation and storage of biological specimens for genetic or molecular analysis in this trial/future use {33}

Saliva/nasal swab samples from participants in the experimental condition may be collected for COVID-19 tests. These samples will not be used for analysis or stored for future use.

Statistical methods

Statistical methods for primary and secondary outcomes {20a}

SAS, M Plus, R, and/or Stata statistical software will be used for data analysis; statistical significance will be assessed as $p<0.05$. For the RCT, we will conduct analysis in two stages: cross-sectional analysis at each time point and subsequently conducting longitudinal analysis.

Analyses for primary and secondary outcomes will include a descriptive examination of outcomes for participants at baseline, months 1-6, and 9 months post-baseline. These data are dichotomous (i.e. "Have you ever been diagnosed or tested positive for COVID-19 by a swab or a saliva test?"), nominal (i.e.

COVID-19 symptoms), and continuous (i.e. "If you had to guess, how many of your household/family members have been tested for COVID-19?") in nature. Bivariate analyses will be conducted to examine associations between testing practices and key predictors (intervention group), confounders (i.e. previous infection or vaccination), moderators (i.e. essential worker status, testing fatigue), and demographic characteristics (e.g., age, gender, race, ethnicity). These differences will be examined in bivariate analyses (unadjusted) and multivariable analysis (adjusted).

Interim analyses {21b}

The data analysis team will conduct interim analyses every 6 months during the duration of the trial. The data analysis team will review data on recruitment, participant characteristics, protocol compliance, and study outcomes (improve household-level COVID-19 routine testing, household-level COVID-19 indicated testing, COVID-19 vaccine uptake, seasonal influenza vaccine uptake, adoption of COVID-19 control measures, and household-level mutual aid capacity). This analysis will also assess the differential proportion of self-reported COVID-19 infection between the two trial groups (a safety assessment of the trial primary outcome). There are no planned adjustments of the significance level due to interim analysis.

Methods in analysis to handle protocol non-adherence and any statistical methods to handle missing data {20c}

This trial will follow a per-protocol analysis to address non-adherence. We will analyze the results using both the intent-to-treat and per protocol analysis approaches. We will use the intent-to-treat approach when reporting the results. In addition, we will pursue the per protocol approach for sensitivity analysis.

In some analyses, there is likely to be missing data due to a respondent not answering a question. In general, this occurs infrequently, but occasions may arise where missing data must be formally dealt with. Data can be missing at random (MAR), missing completely at random (MCAR) or missing in a systematic way that precludes application of simple methods of missingness, such as the Expectation-Maximization (EM) methods. To gain perspective on the nature of the missingness for a given variable, we will create a dummy variable coded for each respondent as 1 = has a missing value on the variable in

question and 0 = does not have a missing value, and then test for associations between these variables and other variables in the models. We will also apply Little's multivariate test for MCAR. Ideally, missingness will not be related to other variables. Missing data also can result from study attrition. We will differentiate these two sources of missingness and explore the dynamics of each. We will approach missing data using either Full Information Maximum Likelihood methods, multiple imputation methods or systematically model missing data bias, depending on the nature of the data and the models being evaluated.

Oversight and monitoring

Composition of the coordinating center and trial steering committee {5d}

The overall study leadership and staff will implement the study as three separate teams: the data collection team, the intervention team, and the data management team. The data collection team will be overseen by Dr. Hagan and will implement all aspects of participant recruitment, enrollment/consent, and data collectors. The intervention team will be overseen by Dr. Guilamo-Ramos and will implement delivery of the NCFP intervention. The data management team will be overseen by Dr. Goodman and is responsible for data management in REDCap. These three teams are kept separate from one another to reduce the risk of contamination and allow the data collection team to remain blinded.

Composition of the data monitoring committee, its role and reporting structure {21a}

Data Safety and Monitoring Board will include a statistician/methodologist and two physicians who are highly experienced in study monitoring. The DSMB will review blinded reports of social or clinical outcomes and other adverse events.

Adverse event reporting and harms {22}

Adverse events will be brought to the attention of the principal investigators of the study. The events will immediately be reported to the Institutional Review Board (IRBs) at New York University (NYU) and Duke University. The event will also be reported to the Sponsor's Program Officer and the DSMB

subsequently. The IRB will determine if it is necessary to halt or terminate the study or if modifications to the study protocol are needed.

Plans for communicating important protocol amendments to relevant parties (e.g. trial participants, ethical committees) {25}

Substantive changes to the protocol that have the potential to affect study aims or methods will be approved by the study's Program Officer at NIH prior to submission to the NYU IRB for approval. Changes to the protocol will be submitted to the NYU IRB for approval and will not be implemented prior to approval. The Program Officer at NIH will be informed of any other (that is, any minor) changes to the study's protocol on an annual basis as one component of the Progress Report. All relevant changes will be reflected in the study's clinicaltrials.gov registry.

Dissemination plans {31a}

The study's results will be disseminated in peer-reviewed journals, national conferences, and other publications. Once the trial has concluded, all data that was collected will be stored in a repository. As we complete data analysis, our team will host community forums to disseminate the results to the community and develop a set of COVID-19 Best Practices.

Discussion

If successful, the NCFP intervention will be the first to form a partnership between nurses, community health workers, and families to help mitigate COVID-19 at the household level in underserved communities with a disproportionate impact of COVID-19. Previous literature has demonstrated that the risk of COVID-19 transmission is greatest inside the home. This particular nurse-driven approach is novel because it addresses this issue by focusing on COVID-19 mitigation at the family/household level.

National efforts to mitigate COVID-19 at the community level have been prioritized in hopes to reduce the rate of transmission through community spread [18]. For instance, current CDC guidelines suggests that if an individual was within close contact of someone who has a known or suspected case of

COVID-19, then the individual should remain at home and isolate from others to break the chain of transmission [18]. Additionally, the CDC recommends individuals who have been in close contact with someone who has a suspected or known case of COVID-19 to get tested immediately. While this strategy has proven to slow the rate of COVID-19 transmission, it does not take into consideration that the risk to contracting COVID-19 is much higher within a household. However, little to no guidance exists to help address this issue. More specifically, existing guidance are difficult to follow in communities like Mott Haven, where conditions such as crowded households, the inability to work from home, and frequent reliance on public transportation make it challenging to practice social distancing.

The NCFP intervention addresses this shortcoming in several ways. First, the focus of the intervention is to help mitigate COVID-19 at the household level by developing a sustained partnership between nurses, CHWs, and families to increase the uptake of feasible strategies at home. Through regular at-home visits by nurses and CHWs, families receive relevant information on how to slow the rate of COVID-19 transmission at home and be offered COVID-19 tests free of charge. The NCFP intervention also helps to create an infection control plan that is uniquely tailored to each household's circumstances. Therefore, the mitigation strategies these households practice will make a difference in minimizing the COVID-19 impact at home. Through this sustained partnership, the intervention delivery team will build a relationship with these households based on mutual trust and cooperation, so households will be more inclined to incorporate COVID-19 mitigation behavior in their daily routine.

There are a few limitations that should be considered in this trial. First, the outcome measures relied on self-reports, which may be biased on the basis of social desirability and recall. The random assignment of participants will ensure that an equal amount of social desirability will be present in both study arms; therefore, social desirability will not bias the results. The study's outcomes will also be assessed on a monthly basis to eliminate any recall bias. Second, we recruited participants in a single geographic and clinic setting, so overall generalizability to other settings should be considered. However, recruitment from Mott Haven will increase generalizability to underserved communities that have also

faced a disproportionate impact of COVID-19. Third, there is a possibility that cross-contamination may occur between the intervention and control groups. Meaning, there is a chance the control group may receive some portion of the intervention material without intending to. The research team has taken measures to prevent this from happening. The intervention delivery team (nurses and CHWs) will not be in contact with the control group at any point during the study. The research staff that do interact with the control group (i.e. through the recruitment process) will not have any knowledge of the intervention material; therefore, the language they use when recruiting or consenting the control group will not allude to what the intervention group will specifically receive. The intervention study arm will also be instructed to not share any intervention material with other families in their community. Furthermore, there is a possibility that not all eligible household members may be completely enrolled. For instance, there may be cases where a particular eligible age group within a household decides to not participate in the study. Nonetheless, this should be true in both study arms due to random assignment, so the chances of results being systematically skewed for one study arm and not the other arm would be low.

The NCFP intervention may offer an opportunity to improve COVID-19 mitigation strategies for underserved communities. The study is novel for integrating a care delivery team that is capable in assessing and meeting the needs of families who have been disproportionately impacted by COVID-19. We predict this program can be effective in improving COVID-19 testing uptake, COVID-19 vaccination uptake, COVID-19 infection control measures and seasonal influenza vaccine uptake in these communities. If the trial successfully achieves this, we infer this care delivery model has the potential to join national efforts in fighting COVID-19 by expanding the cadre of effective mitigation strategies designed for households.

Trial Status

Trials guidance: Authors should report the protocol version number and date, the date recruitment began, and the approximate date when recruitment will be completed.

Protocol Version 1: _____

Recruitment Start Date: July 23rd, 2021

Current Status: Recruiting

Anticipated End Date: July 31, 2022

Abbreviations

Trials guidance: If abbreviations are used in the text they should be defined in the text at first use, and a list of abbreviations should be provided.

COVID-19

NCFP: Nurse-Community Health Worker-Family Partnership

PPE: Personal Protective Equipment

CHW: Community Health Worker

PCR COVID-19 Test: Polymerase Chain Reaction COVID-19 Test

CDC: Centers for Disease Control and Prevention

PASS: Power Analysis and Sample Size

DSMB: Data Safety Monitoring Board

RADx-UP: Rapid Acceleration of Diagnostics Underserved Population

NIH: National Institutes of Health

MAR: Missing At Random

MCAR: Missing Completely At Random

EM: Expectation-Maximization

IRB: Institutional Review Board

NYU: New York University

USD: United States Dollar

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Ethics approval and consent to participate {24}

The institutional review boards at New York University and Duke University approved the study protocol. The clinicaltrials.gov primary register database approved the protocol on 04/06/2021.

All written consent from participants are obtained prior to enrollment.

Consent for publication {32}

N/A

Competing interests {28}

The principal investigators declare no financial or competing interests.

Author's Information (optional)

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