Health and economic impact of COVID-19, surveillance, and vaccination among people experiencing homelessness in Seattle-King County, Washington

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Abstract

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The COVID-19 pandemic has disproportionately affected people experiencing homelessness, with shelters often representing a hotspot for outbreaks due to the elevated risk of viral transmission. COVID-19 surveillance in congregate living settings is vital for mitigating pandemic-related harms, especially among high-risk populations. Additionally, ensuring high COVID-19 vaccination coverage is crucial to prevent morbidity and mortality. However, the impact of COVID-19 and mitigation measures among homeless shelter populations remains uncertain.

In the following dissertation, we address these gaps utilizing both longitudinal and cross-sectional data from the Seattle Flu Study among adults in 23 congregate shelters in the Seattle-King County area from January 2020 through April 2022. In **Chapter 1** we

evaluate the prevalence, characteristics, and impact of long COVID among sheltered people experiencing homelessness and assess the risk of symptom presence at follow-up among those who tested positive versus negative for SARS-CoV-2. In **Chapter 2** we describe shelter staff and residents' experiences and perceptions of COVID-19 vaccination over time, as well as provide recommendations to improve vaccine acceptability among people experiencing homelessness. This utilized a mixed-methods approach with both quantitative surveys (**Chapter 2a**) and qualitative semi-structured interviews and focus groups (**Chapter 2b**) to explore characteristics and reasons associated with changes in vaccine attitudes. In **Chapter 3** we develop a Markov model to estimate health outcomes and costs to determine the cost-utility of pandemic COVID-19 surveillance testing in homeless shelters by vaccination coverage.

We found that shelter residents reported a high prevalence of symptoms 30+ days after their SARS-CoV-2 detection, though few accessed medical care for persistent illness. Intent to be vaccinated against COVID-19 increased from 45% when recalling attitudes in March 2020 to 74% as of August 2021, and was similar among residents and staff. Participants presented recommendations to improve COVID-19 vaccination information content and dissemination, vaccine access, and use of incentives to improve coverage in shelter settings. Modeled findings emphasized that implementation of COVID-19 testing at shelters can be a cost-effective pandemic response.

Altogether, these results highlight the burden of long COVID, the cost-effectiveness of surveillance, and opportunities to improve vaccination coverage with shelter residents

and staff. Findings support recommendations for COVID-19 and future outbreak mitigation for key stakeholders, including shelters, public health, and policymakers.

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DEDICATION

To my dad, Dr. David R. Cox, who loved and encouraged me to ask questions, follow my passions, and make an impact. And to the millions of people who are currently experiencing homelessness around the world– may the human rights of health and housing be realized for all.

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INTRODUCTION

Since the emergence of SARS-CoV-2, the virus that causes COVID-19, there have been approximately 700 million confirmed infections and more than six million deaths due to COVID-19 globally as of August 2023.[1] SARS-CoV-2 is spread primarily from person to person through respiratory droplets produced when an infected person coughs, sneezes, or talks.[2] While symptoms usually appear two days to two weeks after someone is exposed to the virus, there is evidence of lasting health consequences among a substantial minority of infected individuals. The World Health Organization declared COVID-19 as a pandemic on March 11, 2020,[3] and the US declared COVID-19 a national emergency on March 13, 2020.[4] On March 23, 2020, Washington state governor signed a Stay Home – Stay Healthy order prohibiting all people in Washington State from leaving their homes or participating in social, spiritual, and recreational gatherings of any kind.[5] The widespread social, psychological, and economic impacts of the COVID-19 pandemic have had a disproportional impact on marginalized populations, specifically people experiencing homelessness, incarcerated, racial, ethnic, sexual, and gender minority populations.[6] Therefore, it is critical to better understand and develop prevention and mitigation services for these key populations.[7]

Homelessness is a major public health issue,[7] with the US Department of Housing and Urban Development defining “homeless” as an individual or family who lacks a fixed, regular, and adequate nighttime residence, and includes those who reside in shelters.[8] Homeless shelters, similar to prisons, border detention centers, and other congregate living settings, are often under-resourced to prevent infectious disease transmission and

outbreaks, and must rapidly adapt service models to mitigate disease spread.[7,9–11] Contributing environmental factors include high resident density, difficulty maintaining physical distance, poor ventilation, shared hygiene facilities, high population turnover, transient contacts, and lack of medical providers, infection control staff and infection control standards.[12] Individual factors among people experiencing homelessness, such as a high prevalence of comorbidities, further increase the risk of morbidity and mortality from infectious disease.[7,13] People experiencing homelessness living in shelter settings are therefore at higher risk of respiratory infection than those who are housed.[14]

Data specific to COVID-19 among people experiencing homelessness is limited. Only seven (9%) of the 76 public health agencies with jurisdiction over the most populous counties and cities in the US collect and present data on people experiencing homelessness. Of the seven jurisdictions with available data, people experiencing homelessness with COVID-19 had a 30% higher risk of death than the general population.[15] Another study found that expired eviction moratoriums were associated with a doubling of COVID-19 incidence and a fivefold increase in COVID-19 mortality 16 weeks after moratoriums lapsed.[16] It is critical to better understand COVID-19 and its impact on people experiencing homelessness to develop tailored, sustainable strategies to reduce disparities.[17] This includes the implementation of non-pharmaceutical interventions (e.g., masking, social distancing, and testing), as well as COVID-19 vaccines and medications, to prevent COVID-19 or reduce the severity of disease. Currently, there is a discrepancy between the burden of infectious diseases among

people experiencing homelessness and specific research characterizing optimal intervention strategies to mitigate transmission in the context of shelters.[7]

There is a need to understand long COVID among people experiencing homelessness. Long COVID, also known as post-COVID conditions, consists of prolonged symptoms after infection with SARS-CoV-2, including fatigue, headaches, loss of taste or smell, and difficulty breathing. These symptoms can often appear weeks after infection, even if initial illness was asymptomatic.[18] Studies have shown a varying prevalence of long COVID during initial and subsequent months following infection. As people experiencing homelessness have a high underlying prevalence of chronic health conditions and symptoms,[14,19] long COVID may disproportionately impact this population and exacerbate existing challenges to meeting daily survival needs.[20]

Increased use and availability of COVID-19 vaccines may have influenced attitudes regarding vaccination among people experiencing homelessness, but this has not been studied. A cross-sectional study conducted in Seattle-King County, WA, prior to widespread COVID-19 vaccine eligibility, found no changes over time in vaccine acceptance among shelter residents or staff.[21] Residents and staff were 55% and 69% accepting of COVID-19 vaccines, respectively, as of February 2021. Among those who were reluctant to get the COVID-19 vaccine, “Other reason” was the most common reason cited (49% residents, 46% staff). Mixed methods studies are needed to evaluate COVID-19 vaccine prevalence, attitudes, and their change over time among shelter residents and staff.

COVID-19 surveillance, particularly in congregate living settings with marginalized populations at high-risk for severe adverse outcomes, is important to mitigating pandemic harms, but the costs of regular SARS-CoV-2 testing are unclear. Increasing access to COVID-19 testing and enhancing mitigation strategies among people experiencing homelessness is a public health priority. However, little is known about the health and economic impact of COVID-19 testing in this population, especially given current COVID-19 vaccine coverage.

This dissertation aims to fill these critical research gaps by employing both quantitative and qualitative analyses to provide a comprehensive picture of COVID-19, vaccine attitudes, and the health and economic impact of mitigation strategies among homeless shelter residents and staff in Seattle-King County, WA. We utilize data from the Seattle Flu Study (SFS), which represents the first and most comprehensive pandemic viral surveillance study in homeless shelter settings globally, including active surveillance of both asymptomatic and symptomatic SARS-CoV-2 from January 2020 to May 2021, with a subset of participants who were followed longitudinally through April 2022.[22,23] Findings support recommendations for COVID-19 for key stakeholders, including shelters, public health, and policymakers. Furthermore, the evidence gathered may be translated to plan for future pandemic preparedness and resource allocation. As COVID-19 continues to have a devastating impact globally, these findings will help to better understand and develop novel recommendations to reduce morbidity and mortality among people experiencing homelessness.

CHAPTER 1. BURDEN OF LONG COVID AMONG ADULTS EXPERIENCING SHELTERED HOMELESSNESS: A LONGITUDINAL COHORT STUDY IN KING COUNTY, WA BETWEEN SEPTEMBER 2020 - APRIL 2022

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Preface

This Chapter contains a manuscript published in the journal BMC Public Health (06 June 2023).[24]

Abstract

Background: People experiencing homelessness (PEH) are at increased risk for acquiring SARS-CoV-2, but the burden of long COVID in this population is unknown.

Methods: We conducted a matched prospective cohort study to assess the prevalence, characteristics, and impact of long COVID among sheltered PEH in Seattle, WA between September 2020—April 2022. Adults ≥18 years, residing across nine homeless shelters with active respiratory virus surveillance, were eligible to complete in-person baseline surveys and interval follow-up phone surveys. We included a subset of 22 COVID-19-positive cases who tested positive or inconclusive for SARS-CoV-2 and 44 COVID-19-negative controls who tested negative for SARS-CoV-2, frequency matched on age and sex. Among controls, 22 were positive and 22 were negative for one of 27 other respiratory virus pathogens. To assess the impact of COVID-19 on the risk of symptom presence at follow-up (day 30–225 post-enrollment test), we performed log-linear regression with robust standard errors, adjusting for confounding by shelter site and demographic variables determined *a priori*.

Results: Of 53 eligible COVID-19 cases, 22 (42%) completed ≥1 follow-up survey. While five (23%) cases reported ≥ 1 symptom at baseline, this increased to 77% (10/13) between day 30–59 and 33% (4/12) day 90+. The most commonly reported symptoms day 30+ were fatigue (27%) and rhinorrhea (27%), with 8 (36%) reporting symptoms that interfered with or prevented daily activities. Four (33%) symptomatic cases reported receiving medical care outside of a medical provider at an isolation facility. Of 44 controls, 12 (27%) reported any symptoms day 90+. Risk of any symptoms at follow-up was 5.4 times higher among COVID-19 cases compared to controls (95% CI: 2.7–10.5).

Conclusions: Shelter residents reported a high prevalence of symptoms 30+ days after their SARS-CoV-2 detection, though few accessed medical care for persistent illness. The impact of COVID-19 extends beyond acute illness and may exacerbate existing challenges that marginalized populations face in maintaining their health and wellbeing.

Keywords: *COVID-19, SARS-CoV-2, Homelessness, Long COVID, Post-COVID-19 conditions*

Background

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) infection is associated with multiple prolonged symptoms and sequelae that can impact daily living, known as post-COVID-19 conditions or "long COVID."[18,25–27] Symptoms of long COVID include fatigue, cough, difficulty breathing, loss of taste or smell, cognitive impairment, insomnia, and autonomic dysfunction.[18,25–28] The definition of long COVID continues to vary and evolve, highlighting our limited understanding of its nature and underlying mechanisms. However, the World Health Organization currently defines post-COVID-19 conditions as illness consisting of symptoms that are present three months after probable or confirmed SARS-CoV-2 infection, have a minimum duration of two months, and cannot be explained by an alternative diagnosis.[26]

Studies have shown widely varying prevalence of long COVID during subsequent months following infection, higher in populations requiring hospitalization during acute COVID-19 illness.[29] A meta-analysis of 54 studies, mostly of non-hospitalized individuals with symptomatic acute COVID-19 illness, estimated that 6.2% of individuals experienced ≥1 persistent symptom three months after acute illness.[30] Long COVID's clinical presentation, frequency, and impact may vary among different populations,[31] and there is a need to better understand prevalence and persistent outcomes among high-risk groups, particularly marginalized populations and those with barriers to accessing care.

The COVID-19 pandemic has disproportionately affected people experiencing homelessness (PEH), with congregate shelters often representing a hotspot for outbreaks.[32–36] To our knowledge, there are no currently published studies describing long COVID among PEH. We hypothesized that there would be a high burden of long COVID among PEH given elevated rates of underlying medical conditions and increased risk for severe COVID-19 disease compared to the general population.[14,19] Moreover, surveys and interviews of patients with long COVID have reported significant, negative effects on physical and psychiatric health, employment, and access to medical care— impacts that may be amplified in unhoused populations and can exacerbate existing barriers to health, housing, and medical care.[20,37–39]

This study aimed to characterize the burden and impact of long COVID among adult shelter residents in King County, Washington between September 2020—April 2022, using a prospective cohort of COVID-19-positive cases and COVID-19-negative controls, frequency matched on age and sex.

Methods

Study design

To assess long COVID among shelter residents, we used a frequency-matched prospective cohort study design, nested within the Seattle Flu Study's (SFS) cross-sectional, community-based respiratory virus surveillance. As previously described,[22,23] SFS instituted active routine surveillance three to six days per week among

shelter residents and staff ≥3 months of age specifically for SARS-CoV-2 starting in March 2020.

Study participants

Adults ≥18 years whose primary residence was at one of nine homeless shelters with active surveillance between 9/1/2020–5/31/2021 were eligible to participate in this sub-study (Table 1.1). This included a mix of adult, family, and young adult shelters, selected to be socio-demographically representative of King County's sheltered PEH population (Appendix 1.1, Supplemental Table 1.1). Shelter sites were identified by the study team in collaboration with Public Health - Seattle & King County and community partners. Study enrollment was open to shelter residents and staff regardless of symptoms. Each shelter participant was limited to one enrollment and nasal swab per week unless they developed new or worsening cough or ≥2 acute respiratory illness symptoms (i.e., fever, cough, sore throat, dyspnea, rhinorrhea, myalgia, or headache) in the seven days following last enrollment.

COVID-19 cases tested positive or inconclusive for SARS-CoV-2 and agreed to participate in follow-up survey(s). Each case was offered an isolation unit within the shelter or an off-site isolation unit by Public Health - Seattle & King County where they had access to medical care. Controls were those who agreed to participate and were: (1) negative for SARS-CoV-2 and other respiratory viruses (ORVs) (COVID-19-negative, ORV-negative controls, n = 22), or (2) negative for SARS-CoV-2 but positive

for an ORV (COVID-19-negative, ORV-positive controls, n = 22) (Appendix 1.1, Supplemental Figure 1.1). All controls were asked about any infection at follow-up. Participants who self-reported testing positive or inconclusive for SARS-CoV-2 before their follow-up interview were excluded from the control group. Cases and controls were frequency-matched by sex and age.

Data collection

Self-collected mid-nasal swabs and enrollment surveys were provided by all participants. Samples were tested for 27 respiratory pathogens using a TaqMan reverse transcriptase polymerase chain reaction (PCR).[23] The study team conducted interval phone follow-up surveys between day 5–365 after initial swabbing. COVID-19 cases had follow-up attempts at approximately 5, 10, 30, 60, 180, and 365 days post-enrollment. COVID-19 controls had one follow-up between 90–225 days post-enrollment. Control surveys did not state the SARS-CoV-2 or other PCR test results and instead, only referenced the date at which testing was completed.

Study staff called participants on the phone number provided during baseline enrollment when available; if not, study staff coordinated with shelter management to connect with participants' rooms if still residing at the shelter site. For each individual, three contact attempts were made at each time point. For all participants who primarily spoke a language other than English, a certified medical interpreter was used to complete the survey. All survey data were collected and entered electronically in Research Electronic Data Capture (REDCap). The enrollment questionnaire (Appendix 1.2)[23] and long

COVID follow-up questionnaires (Appendix 1.3 and 1.4) are included in supplementary materials. We offered $10 gift cards to compensate COVID-19-positive participants for their time at 180 and 365 day survey time points. This study was approved by the Human Subjects Division of the University of Washington Institutional Review Board (STUDY00007800).

Main measures

The primary exposure was COVID-19 case status (binary), where COVID-19-positive cases (who tested positive or inconclusive for SARS-CoV-2) represent the “exposed” group and COVID-19-negative controls (who tested negative for SARS-CoV-2) represent the “unexposed” group. The primary outcome was one or more symptom(s) at follow-up between day 30–225 post-enrollment test (binary). For COVID-19 cases with more than one follow-up survey completed between day 30–225 post-enrollment, the survey from the median time point was selected and used. Symptoms included subjective fever, headache, cough, chills, sweats, sore throat, rhinorrhea, fatigue, myalgias, trouble breathing, ear pain or discharge, nausea or vomiting, rash, and loss of smell or taste. The enrollment questionnaire included data on underlying medical conditions, smoking status, shelter use, and duration of homelessness. Underlying medical conditions included asthma, blood disorders (e.g., sickle cell disease), cancer, chronic obstructive pulmonary disease or emphysema, chronic bronchitis, immunosuppression, liver disease, heart disease, or diabetes. Follow-up questionnaires collected information on residual symptoms, receipt of medical care, impact on

work or school absenteeism, impact on daily activities, and the CDC Healthy Days Core Module and Activities Limitations Module to assess health-related quality of life (HR-QOL) at each time point.[40] If a participant did not complete the day five questionnaire, they were asked to recall their HR-QOL prior to COVID-19 diagnosis on the first follow-up questionnaire.

Data analysis

Descriptive statistics were used to characterize our primary measures and covariates of interest at various survey time points. We performed log-linear regression to assess the association between exposure and risk of presence of symptom(s) at follow-up between day 30–225. Specifically, Poisson regression models were fitted using generalized estimating equations (GEE) to account for possible correlation within shelter sites. Risk ratio (RR) estimates were obtained, and Wald-based confidence intervals and hypothesis tests were conducted using robust standard error estimates. The primary analysis examined cases versus controls, while the secondary analysis used a three-level case status exposure: (1) COVID-19-positive case, (2) COVID-19-negative and ORV-negative control, and (3) COVID-19-negative and ORV-positive control. In both models, we assessed for interaction between case status and time since enrollment, as we hypothesized that symptoms reported among controls would remain constant while symptoms among cases would decline over time. While controls were not at risk for long COVID, it was important to assess symptoms reported in a comparator group given higher rates of chronic, underlying medical conditions among PEH.

Key confounders identified *a priori* from the literature included follow-up time since enrollment,[41] follow-up season,[42] race,[43–46] any comorbidities,[18,25,43,47–53] income,[47] and smoking status.[18,25,43,47–53] Other covariates deemed potential confounders included duration of homelessness,[12,36,54–58] employment, insurance,[43,59] education,[59,60] and Hispanic ethnicity.[43,45,51,60] To more flexibly model the effect of follow-up time since enrollment (centered at 90 days) on the log RR of symptom(s) at follow-up, we used restricted cubic splines with three knots (at the fifth smallest, median, and fifth largest data points).[61,62] In sensitivity analyses, both primary and secondary analyses adjusted for all confounders identified *a priori* using a bivariate screening procedure to reduce the number of covariates included, (≥5%-point difference across strata between both the frequency of the exposure by covariate level and the frequency of the outcome by covariate level), followed by a forward selection procedure (starting with strongest confounders in our data, ensuring that the estimate of interest (i.e., log RR) did not have an absolute change of more than 0.5 and that inclusion/exclusion of the null in the confidence interval did not change). We also present results of the full model. All analyses were performed using R Statistical Software Version 4.0.3.

Results

Participant characteristics: COVID-19-positive cases

Between 9/1/2020–5/31/2021, 53 adult shelter residents tested positive (n = 50) or inconclusive (n = 3) for SARS-CoV-2 (Appendix 1.1, Supplemental Figure 1.1). Of these cases, 22 (42%) completed one or more follow-up questionnaires and were included in this analysis (Table 1.1; Appendix 1.1, Supplemental Table 1.2). Cases reached were

similar to those unable to be reached with the exception of providing a phone number to contact (77% vs. 48%) (Appendix 1.1, Supplemental Table 1.3). The median age of cases was 45 years (range: 20, 66). Half (n = 11) reported male sex at birth and most identified as either Black/African American (46%, n = 10) or White (18%, n = 4). The majority of cases (55%, n = 12) reported chronic homelessness (duration of ≥ 1 year), having health insurance (68%) and being unemployed (59%). Six (27%) self-reported ≥1 underlying medical condition and nine (41%) indicated that they were smokers. Three (8%) of COVID-19-positive cases were co-infected with an ORV at enrollment, all of which were rhinovirus.

Self-reported symptoms and medical care

Five (23%) cases at baseline enrollment were symptomatic, of which four indicated having one symptom, while one participant indicated having eight symptoms (Figure 1.1; Appendix 1.1, Supplemental Figure 1.2). The mean time to follow-up after COVID-19 diagnosis was 85 ± 40 days (Table 1.1; Appendix 1.1, Supplemental Figure 1.3). The most common symptoms reported at follow-up were fatigue (27%), runny nose (27%), muscle or body aches (23%), and sore throat (18%) (Figure 1.1). All four cases reached for follow-up between day 5 - <10 were symptomatic. Approximately 77% of COVID-19 cases (10/13) surveyed had symptoms between day 30 - <60, with an even distribution of symptoms preventing, interfering with, and not impacting daily activities. The prevalence of persistent symptoms after acute COVID-19 decreased to 30% at day 60 - <90, 33% at day 90 - <180, and 33% at day 180+. By day 60+, 43% of people who reported symptoms indicated that at least one prevented daily activity (Figure 1.2).

The majority of COVID-19-positive cases (70%, n = 18) reported not receiving medical care outside of a provider at an isolation and quarantine facility day 30+ (Figure 1.3). The proportion of COVID-19-positive cases without medical care in the last three months increased over time. While approximately 35% received no medical care ≤60 days since SARS-CoV-2 infection, this increased to approximately 85% without medical care 180+ days since infection. Only four participants sought care elsewhere.

Self-reported HR-QOL and impact on activities of daily living

Participants' self-rated health prior to COVID-19 illness and at follow-up intervals is shown in Figure 1.4a. The mean number of days that physical health was reported to be "NOT good" and that poor physical or mental health prevented usual activities in the past 30 days increased for all but one follow-up time point compared to prior to SARSCoV-2 infection. The mean number of days that mental health was reported to be "NOT good" in the past 30 days initially decreased then returned to baseline compared to prior to SARS-CoV-2 infection. In approximately half of cases, a positive COVID-19 test impacted daily activities between day 30 - <150 (Figure 1.4b). The most commonly impacted activities included work or looking for work (30%-33%), socializing (23%-40%), running errands (17%-40%), and caring for self or others (23%-33%).

<u>Participant characteristics: COVID-19-negative controls</u>

Among controls (n = 44), a smaller proportion reported chronic homelessness (27%), unemployment (52%), or that they were smokers (36%), while a larger proportion had

educational attainment higher than high school (61%) or were insured (80%) compared to COVID-19 cases (Table 1.1; Appendix 1.1, Supplemental Table 1.4). COVID-19-negative controls reported lower overall prevalence of symptoms at baseline (13% vs. 23%) and follow-up (27% vs. 41%) compared to COVID-19-positive cases, despite increasing in both groups.

Among COVID-19-negative ORV-positive controls, 73% (n = 16) tested positive for rhinovirus. ORVs identified included seasonal coronavirus (n = 3), parainfluenza (n = 1), metapneumovirus (n = 1), and adenovirus (n = 1). COVID-19-negative controls who were ORV-positive (compared to ORV-negative) had a lower prevalence of symptoms at both baseline (9% vs. 18%) and follow-up (23% vs. 27%). The mean time to follow-up after COVID-19 diagnosis was 151 ± 40 days versus controls ORV-positive (169 ± 39) and ORV-negative (132 ± 31).

Risk of persistent symptoms

Table 1.2 presents risk of persistent symptoms and sensitivity analyses from regression models. In the primary analysis model adjusting only for the confounders of follow-up season and time (in addition to age and sex due to frequency matching in study design), the estimated risk of symptoms at follow-up was 5.4 times higher among COVID-19 cases compared to controls (95% CI: 2.7–10.5). This relationship remained significant in sensitivity analyses when adjusting for additional confounders (RR = 5.7, 95% CI: 1.1–30.3) and in the full model including all potential confounders (Table 1.2). In the secondary analysis separating COVID-19-negative controls by ORV result, the

estimated risk of symptoms at follow-up were 6.3 (95% CI: 1.8–21.7) and 4.2 (95% CI: 1.5–11.9) times higher among COVID-19 cases compared to ORV-positive and negative controls, respectively. After adjusting for the same set of additional confounders, this relationship remained significant among COVID-19-negative, ORV-positive controls (RR = 7.1, 95% CI: 1.2–41.7). However, among COVID-19-negative, ORV-negative controls the estimated risk was no longer statistically significant after adjustment. We found no evidence of interaction between case status and time since enrollment in either model, and thus presented models do not include an interaction term.

Discussion

Our study is the first to characterize long COVID specifically in PEH, a population that has been demonstrated to be at increased risk for acute COVID-19 illness and faces multiple barriers to accessing medical care and participating in longitudinal research studies. We found that among PEH in the Seattle metropolitan region, COVID-19-positive cases were at five times higher risk of persistent symptoms between 30–225 days post-testing when compared to COVID-19-negative controls. The prevalence of persistent symptoms after SARS-CoV-2 infection decreased with time. Approximately 30% of those with persistent symptoms reported ≥1 that prevented daily activity at all follow-up time points, yet the majority did not seek medical care despite the substantial burden and impact of their symptoms.

The prevalence of persistent COVID-19 symptoms in our sample of sheltered PEH between day 30–225 appears to be higher than the estimated 10–35% cited in a meta-analysis of patients in the general population of high-income countries after mild SARS-CoV-2 infection.[63] However, given our small sample of cases who tested positive or inconclusive for SARS-CoV-2, results should be interpreted with caution. Additionally, we caution against drawing excessive conclusions from our findings, especially beyond descriptive statistics for COVID-19 cases within each follow-up interval presented in Figures 1.2, 1.3 and 1.4. In a longitudinal prospective cohort from Washington state, approximately 33% of outpatients reported at least one persistent symptom at six months post-infection.[64] These estimates are much higher than the estimated 6% global prevalence of at least one persistent fatigue, respiratory, or cognitive symptom three months after symptomatic acute COVID-19 illness.[30] The most common long COVID symptoms associated with SARS-CoV-2 infection in our study were similar to those recognized in previous studies, such as fatigue[63] and respiratory symptoms.[30] A surprising finding was that 27% of COVID-19-negative controls reported symptoms at follow-up between day 30–225, with a higher prevalence among ORV-negative vs. ORV-positive controls. While the frequency of chronic symptoms similar to post-COVID-19 conditions may explain our higher prevalence of long COVID compared to other studies, adjusting for underlying conditions we estimated that PEH with a positive SARS-CoV-2 test at enrollment were at over five times increased risk of persistent COVID-19 symptoms compared to those with a negative test. This demonstrates the impact of COVID-19 illness on PEH beyond the increased risk of acute infection.

Our study suggests that long COVID may exacerbate existing challenges that PEH face in health and wellbeing.[65–67] Persistent COVID-19 symptoms impacted participants' key activities such as employment, ability to care for themselves and others, and access to homelessness services. Participants also reported worsened HRQOL from time of positive tests to follow-up. Despite the high prevalence of impactful persistent COVID-19 symptoms and worse overall health, few of our participants sought medical care related to their symptoms. PEH face multiple barriers in healthcare access that result in lower health-seeking behavior or inability to seek care.[68,69] Thus, not only does the addition of persistent COVID-19 symptoms to existing survival demands and chronic illness burden experienced by PEH have the potential to worsen health and socioeconomic disparities between unhoused and housed populations, but PEH are less likely to receive care to mitigate the impact of long COVID.

Strengths and limitations

Our study has several strengths and limitations. This is the first study to describe the impact of long COVID among PEH, a population that experiences a disproportionate burden of acute COVID-19 illness but faces barriers to participating in longitudinal research studies due to housing instability, daily survival demands, and variable access to phones and other communication methods. Most studies on long COVID have focused on advantaged populations in high- and middle-income countries. Thus, additional research focusing on vulnerable and neglected communities, including PEH,

is needed to address health inequities.[70] We were able to follow some participants up to one year following their positive or inconclusive SARS-CoV-2 test and evaluate the impact of long COVID on daily activities and quality of life.

Our study's conclusions are limited by the small sample size, inconsistent follow-up, and differential distribution of follow-up time between cases and controls. Over half of COVID-19 cases and controls were lost to follow-up and unreachable after enrollment. This may lead to differential misclassification of the outcome, where ascertainment of symptoms at follow-up is influenced by COVID-19 case status (e.g., cases may experience worse outcomes and thus be harder to reach, or experience better outcomes and thus not be interested in participating), which could falsely exaggerate or minimize the true association by biasing the observed results upward or downward, but not predictably so. As differential follow-up time between cases and controls is a strong confounder, we chose to include time since enrollment within our regression models using restricted cubic splines to improve upon the flexibility of our model with relative parsimony.[71] However, there still may be residual confounding from differential follow-up that was unaccounted for in our models. While our model adjusted for follow-up time and season, to avoid overfitting and ensure its face validity we did not include all confounders in the primary model.[71] However, sensitivity analyses including key confounders and the full model with all measured potential cofounders resulted in similar conclusions.

Unlike many studies,[25,70] we included a control group of PEH who tested negative for SARS-CoV-2, including half who tested positive for an ORV. However, we did not collect data on self-reported re-infection for cases. As enrollment in weekly surveillance was optional, it is possible that controls had COVID-19 that was never identified and thus not self-reported. Moreover, the fact that symptoms were self-reported may also result in differential misclassification of the outcome, specifically regarding participants' ability to distinguish between long COVID-related symptoms and symptoms related to other chronic diseases. Again, this type of misclassification leads to a less predictable direction of the bias on the observed risk ratio. Lastly, we only included sheltered PEH and did not capture the experience of long COVID in unsheltered PEH.

Conclusion

Shelter residents reported a high prevalence of persistent symptoms 30+ days after their SARS-CoV-2 detection, with a significantly higher risk of symptoms at follow-up among COVID-19 cases compared to COVID-19-negative controls. Symptoms impacted participants' ability to perform key daily activities, yet few participants accessed medical care for persistent illness. The impact of COVID-19 extends beyond acute illness and long COVID may exacerbate existing challenges that PEH face in maintaining their health and wellbeing. These findings provide a preliminary understanding of long COVID in the homeless community to inform public health measures and health service resource allocation among PEH.

Tables and Figures

Table 1.1. Participant characteristics by COVID-19 and Other Respiratory Virus (ORV) case status

	COVID-19+ cases (n=22)*	COVID-19 -, ORV + controls (n=22)*	COVID-19 -, ORV - controls (n=22)*	Overall (N=66)
Age (years)†	45.0 [20.0, 66.0]	37.5 [18.0, 72.0]	44.5 [21.0, 64.0]	44.0 [18.0, 72.0]
Sex (biological)				
Male	11 (50.0%)	11 (50.0%)	11 (50.0%)	33 (50.0%)
Female	10 (45.5%)	10 (45.5%)	10 (45.5%)	30 (45.5%)
Prefer not to say	1 (4.5%)	1 (4.5%)	1 (4.5%)	3 (4.5%)
Hispanic ethnicity				
No	19 (86.4%)	19 (86.4%)	16 (72.7%)	54 (81.8%)
Yes	2 (9.1%)	2 (9.1%)	5 (22.7%)	9 (13.6%)
Prefer not to say	1 (4.5%)	1 (4.5%)	1 (4.5%)	3 (4.5%)
Race				
American Indian or Alaska Native	1 (4.5%)	1 (4.5%)	2 (9.1%)	4 (6.1%)
Asian	0 (0.0%)	1 (4.5%)	2 (9.1%)	3 (4.5%)
Black or African American	10 (45.5%)	9 (40.9%)	7 (31.8%)	26 (39.4%)
Native Hawaiian or other Pacific Islander	1 (4.5%)	1 (4.5%)	2 (9.1%)	4 (6.1%)
White	4 (18.2%)	4 (18.2%)	6 (27.3%)	14 (21.2%)
Multiracial	2 (9.1%)	2 (9.1%)	0 (0.0%)	4 (6.1%)
Other	2 (9.1%)	0 (0.0%)	0 (0.0%)	2 (3.0%)
Prefer not to say	2 (9.1%)	4 (18.2%)	3 (13.6%)	9 (13.6%)
Language				
English	19 (86.4%)	22 (100.0%)	21 (95.5%)	62 (93.9%)
Spanish	2 (9.1%)	0 (0.0%)	1 (4.5%)	3 (4.5%)
Tigrinya	1 (4.5%)	0 (0.0%)	0 (0.0%)	1 (1.5%)
Education				
Less than high school graduate	4 (18.2%)	2 (9.1%)	2 (9.1%)	8 (12.1%)
Graduated high school/obtained GED	7 (31.8%)	6 (27.3%)	6 (27.3%)	19 (28.8%)
Some college‡	3 (13.6%)	6 (27.3%)	8 (36.4%)	17 (25.8%)
Bachelor's or advanced degree	1 (4.5%)	7 (31.8%)	6 (27.2%)	14 (21.2%)
Prefer not to say	1 (4.5%)	1 (4.5%)	0 (0.0%)	2 (3.0%)
Missing	6 (27.3%)	0 (0.0%)	0 (0.0%)	6 (9.1%)

	COVID-19+ cases (n=22)*	COVID-19 -, ORV + controls (n=22)*	COVID-19 -, ORV - controls (n=22)*	Overall (N=66)
Employed				
No	13 (59.1%)	14 (63.6%)	9 (40.9%)	36 (54.5%)
Yes	3 (13.6%)	8 (36.4%)	13 (59.1%)	24 (36.4%)
Missing	6 (27.3%)	0 (0.0%)	0 (0.0%)	6 (9.1%)
Income				
≤ $25,000	10 (45.5%)	10 (45.5%)	15 (68.2%)	35 (53.0%)
> $25,000	1 (4.5%)	6 (27.3%)	5 (22.7%)	12 (18.2%)
Don't know or prefer not to say	5 (22.7%)	6 (27.3%)	2 (9.1%)	13 (19.7%)
Missing	6 (27.3%)	0 (0.0%)	0 (0.0%)	6 (9.1%)
Insurance				
Private	0 (0.0%)	6 (27.3%)	5 (22.7%)	11 (16.7%)
Government	15 (68.2%)	12 (54.5%)	12 (54.5%)	39 (59.1%)
None	0 (0.0%)	3 (13.6%)	4 (18.2%)	7 (10.6%)
Prefer not to say	1 (4.5%)	1 (4.5%)	1 (4.5%)	3 (4.5%)
Missing	6 (27.3%)	0 (0.0%)	0 (0.0%)	6 (9.1%)
Duration of homelessness				
6 months or less	2 (9.1%)	5 (22.7%)	5 (22.7%)	12 (18.2%)
7-12 months	1 (4.5%)	3 (13.6%)	4 (18.2%)	8 (12.1%)
13-24 months	4 (18.2%)	3 (13.6%)	0 (0.0%)	7 (10.6%)
Over 24 months (2 years)	8 (36.4%)	4 (18.2%)	5 (22.7%)	17 (25.8%)
Prefer Not to Say	1 (4.5%)	1 (4.5%)	1 (4.5%)	3 (4.5%)
Missing	6 (27.3%)	6 (27.3%)	7 (31.8%)	19 (28.8%)
Shelter Type				
Mixed gender, ≥ 18 years	11 (50.0%)	9 (40.9%)	7 (31.8%)	27 (40.9%)
Mixed gender, 18 - 25 years	0 (0.0%)	2 (9.1%)	1 (4.5%)	3 (4.5%)
Female, ≥ 18 years	0 (0.0%)	2 (9.1%)	2 (9.1%)	4 (6.1%)
Male, ≥ 18 years	2 (9.1%)	2 (9.1%)	2 (9.1%)	6 (9.1%)
Male, ≥ 50 years	1 (4.5%)	0 (0.0%)	3 (13.6%)	4 (6.1%)
Mixed gender, all ages	8 (36.4%)	7 (31.8%)	7 (31.8%)	22 (33.3%)
Any comorbidities[§]	6 (27.3%)	7 (31.8%)	6 (27.3%)	19 (28.8%)
Smoking status				
None	12 (54.5%)	11 (50.0%)	15 (68.2%)	38 (57.6%)
Tobacco products	9 (40.9%)	10 (45.5%)	6 (27.3%)	25 (37.9%)
Prefer not to say	1 (4.5%)	1 (4.5%)	1 (4.5%)	3 (4.5%)

	COVID-19+ cases (n=22)*	COVID-19 -, ORV + controls (n=22)*	COVID-19 -, ORV - controls (n=22)*	Overall (N=66)
Any symptoms at enrollment	5 (22.7%)	2 (9.1%)	4 (18.2%)	11 (16.7%)
Follow-up time since enrollment (days)†	72.0 [35.0, 183.0]	180 [96.0, 223.0]	123 [96.0, 188.0]	126 [35.0, 223.0]
Follow-up season‖				
Fall	1 (4.55%)	16 (72.7%)	13 (59.1%)	30 (45.5%)
Spring	3 (13.6%)	0 (0.0%)	0 (0.0%)	3 (4.5%)
Winter	18 (81.8%)	0 (0.0%)	0 (0.0%)	18 (27.3%)
Summer	0 (0.0%)	6 (27.3%)	9 (40.9%)	15 (22.7%)
Any symptoms at follow-up[a]	9 (40.9%)	5 (22.7%)	7 (31.8%)	21 (31.8%)

* + = positive; - = negative
† Median [Min, Max]
‡ Some college includes: vocational training, associate's degree
§ Any comorbidities includes: asthma, blood disorders, cancer, chronic obstructive pulmonary disease or emphysema, immunosuppression, liver disease, heart disease, diabetes, neurologic conditions, or aspirin therapy.
‖ Seasons defined by astronomical season in the Northern Hemisphere (using equinox and solstice dates)
[a] Any symptoms at follow-up represents a single follow-up time point between day 30-225 post-enrollment. If a COVID-19 case had more than one follow-up survey complete between day 30-225 post enrollment, the median time point was selected and used.

Table 1.2. Log-linear regression models to assess risk of symptom(s) at follow-up

	aRR	95% CI	p-value
Primary analysis †			
Model A: No covariates [a]			
Case (vs. control)	1.500	(0.949 - 2.371)	0.083
Model B: Add covariates time and follow-up season only [b]			
Case (vs. control)	5.365	(2.731 - 10.539)	<0.001*
Model C: Sensitivity analysis - expanded model [c]			
Case (vs. control)	5.735	(1.086 - 30.285)	0.040*
Model D: Sensitivity analysis - full model [d]			
Case (vs. control)	8.902	(2.015 - 39.324)	0.004*
Secondary analysis ‡			
Model A: No covariates [a]			
Case (vs. Control, ORV-positive)	1.799	(0.663 - 4.902)	0.249
Case (vs. Control, ORV-negative)	1.285	(0.791 - 2.092)	0.311
Model B: Add covariates time and follow-up season only [b]			
Case (vs. Control, ORV-positive)	6.250	(1.805 - 21.739)	0.004*
Case (vs. Control, ORV-negative)	4.237	(1.499 - 11.905)	0.006*
Model C: Sensitivity analysis - expanded model [c]			
Case (vs. Control, ORV-positive)	7.143	(1.206 - 41.667)	0.030*
Case (vs. Control, ORV-negative)	4.237	(0.597 - 30.303)	0.149
Model D: Sensitivity analysis - full model [d]			
Case (vs. Control, ORV-positive)	11.494	(2.045 - 62.500)	0.006*
Case (vs. Control, ORV-negative)	6.494	(1.292 - 32.258)	0.023*

† Primary analysis uses binary exposure (*COVID-19-positive case* vs. *COVID-19-negative control*)
‡ Secondary analysis uses categorical exposure (*COVID-19-positive case* vs. *COVID-19-negative control, ORV-positive* vs. *COVID-19-negative control, ORV-negative*)
[a] Model A represents the model with no covariates, adjusted only for age and sex due to frequency matching in study design
[b] Model B builds upon Model A by also including adjustment for time since enrollment via 4 restricted cubic splines (centered at day 90) and follow-up season (categorical: fall, spring, summer, winter). As we found no evidence of interaction between case status and time since enrollment in either model, the interaction term was not included in the presented results
[c] Model C builds upon Model B by also including adjustment for key covariates identified *a priori*, including race (categorical: White, Black/African American, Other), any comorbidities (binary: yes, no), income (binary: ≥$25,000, <$25,000) and smoking status (binary: smoker, non-smoker), and additional covariates added during bivariate and forward selection screening procedures, including duration of homelessness (categorical: <12 months, 12+ months, prefer not to say/missing) and employment (binary: yes, no)
[d] Model D builds upon Model C by also including adjustment for all remaining potential covariates, including insurance (binary: yes, no), education (binary: high school or less, some college or more), and hispanic ethnicity (binary: yes, no)
*p-value < 0.05

Figure 1.1. Symptoms reported by COVID-19 & Other Respiratory Virus (ORV) case status day 30–225 since enrollment

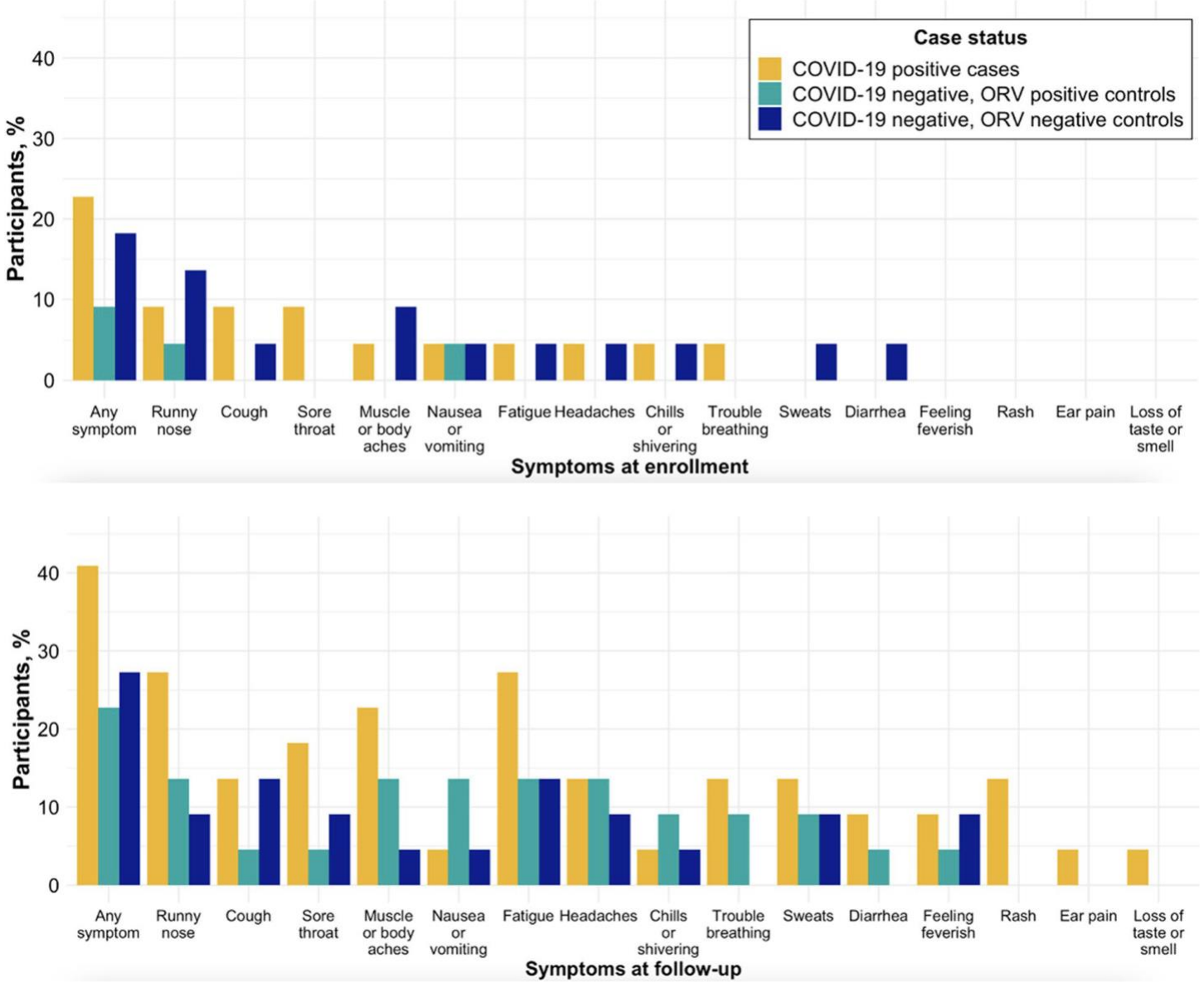


Figure 1.2. Symptom count and impact among symptomatic COVID-19 cases at follow-up time points day 30–225 since enrollment

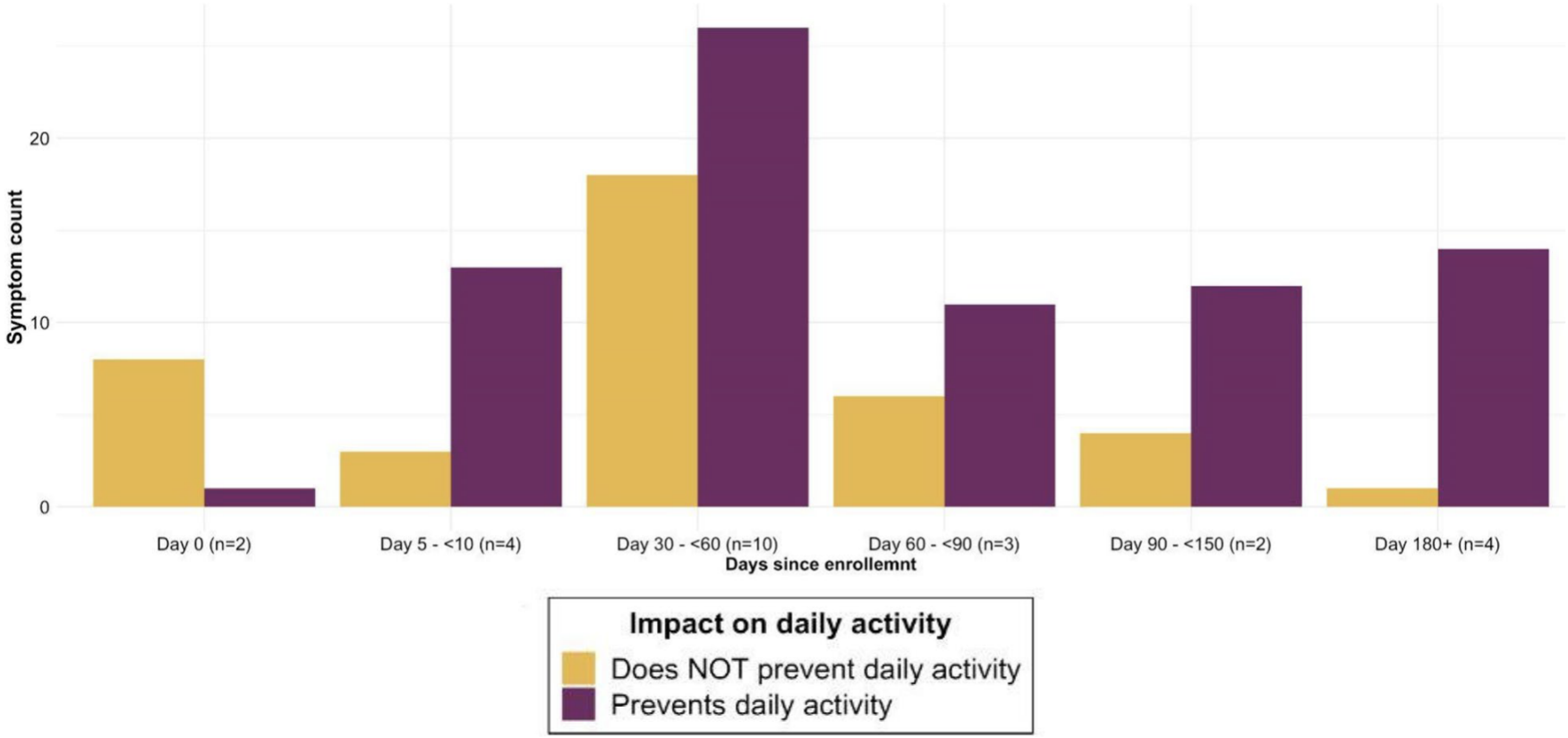


Figure 1.3. Medical care received in the last three months since positive/inconclusive SARS-CoV-2 test by time since enrollment

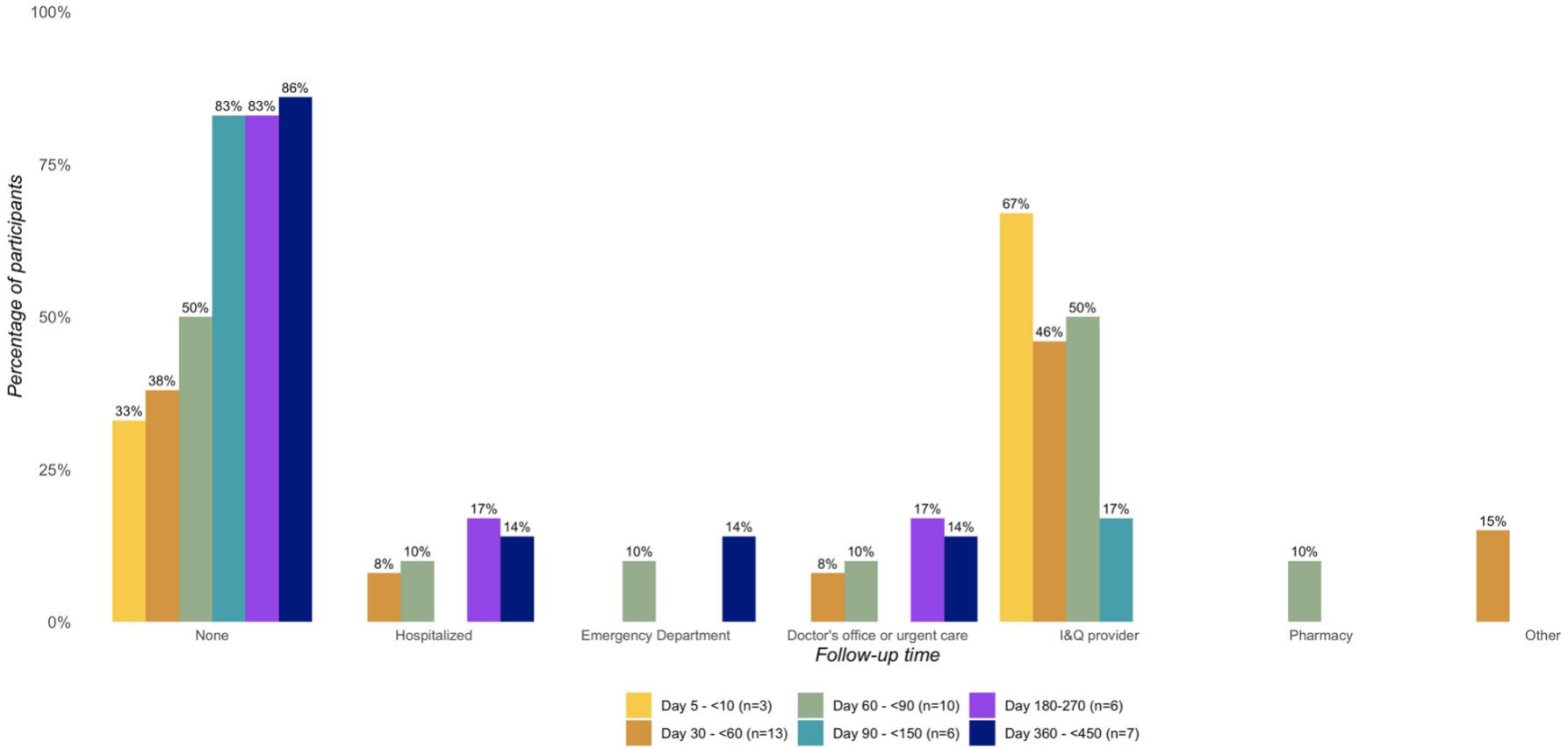
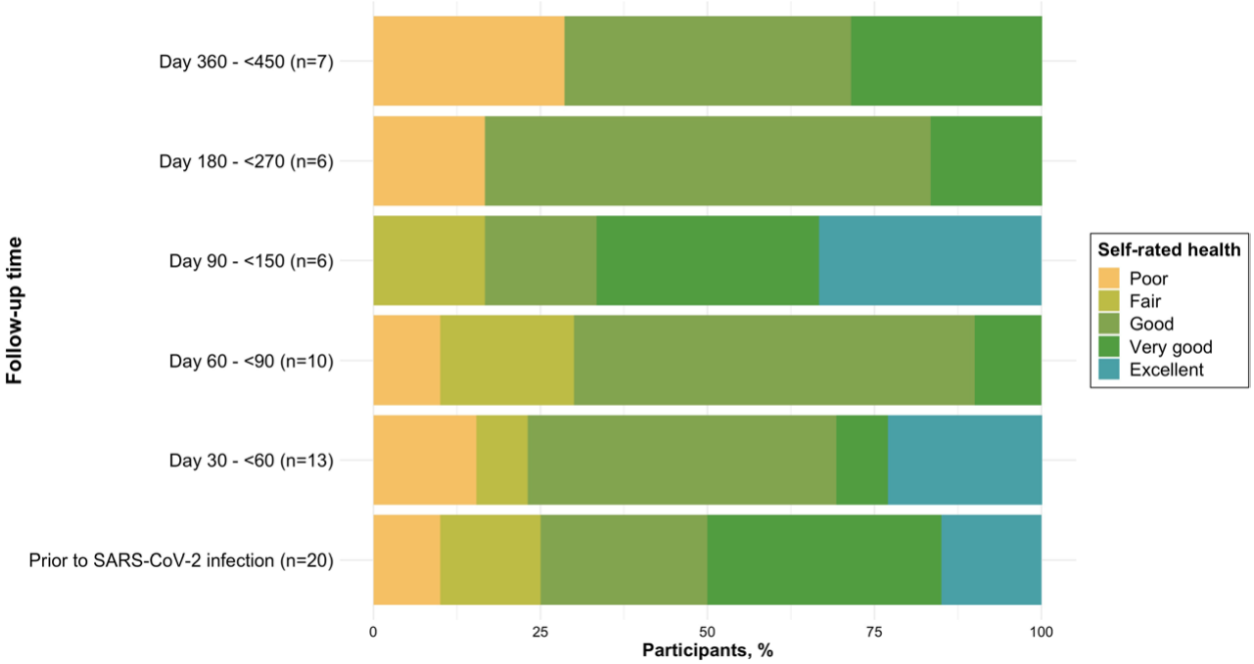
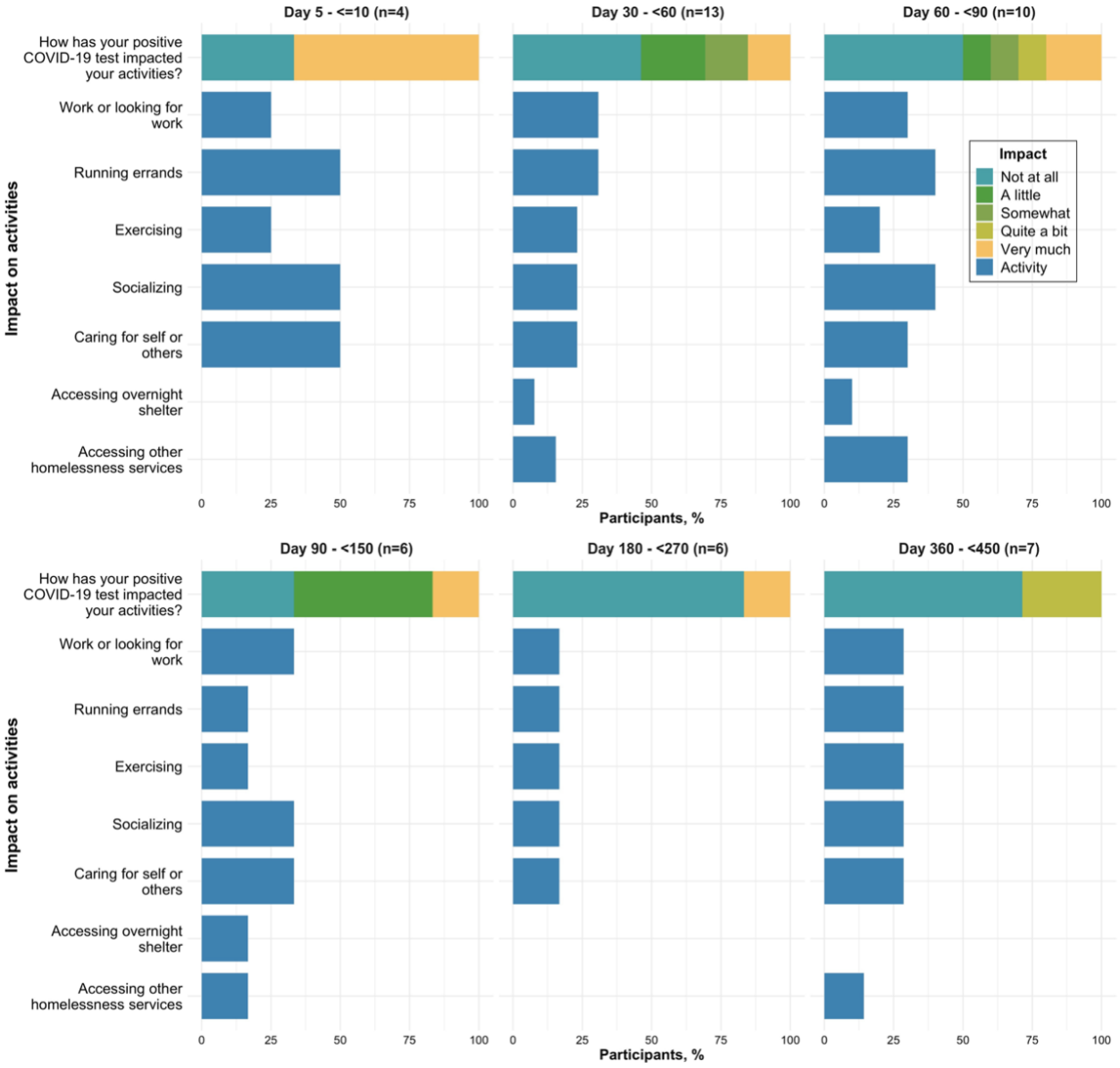


Figure 1.4.a. Health-related quality of life: self-reported health and CDC Healthy Days



		Physically Unhealthy Days/Month	Mentally Unhealthy Days/Month	Unhealthy Days Index/Month
		(mean ± SD)	*(mean ± SD)*	*(mean ± SD)*
Follow-up time after SARS-CoV-2 infection	**Day 360-<450** (n=7)	11.1 ± 12.3	8.7 ± 10.9	12.3 ± 14.0
	Day 180-<270 (n=6)	6.5 ± 11.6	7.8 ± 11.5	7.8 ± 11.7
	Day 90-<150 (n=6)	6.6 ± 13.1	4.2 ± 8.0	5.0 ± 12.2
	Day 60-<90 (n=10)	8.6 ± 10.3	5.2 ± 6.0	4.4 ± 5.3
	Day 30-<60 (n=13)	10.3 ± 13.1	7.7 ± 11.9	8.9 ± 11.0
Prior to SARS-CoV-2 infection (n=21)		5.6 ± 10.0	8.1 ± 10.9	4.8 ± 8.6

Figure 1.4.b. Impact of positive/inconclusive SARS-CoV-2 test on daily activities



Appendix Materials

Appendix 1.1. Supplemental Tables and Figures

Supplemental Table 1.1. SFS Shelter sites where sample collection occurred, 1 October 2019 – 31 May 2021

Shelter	Maximum capacity	Resident sex	Resident age range	Sleeping arrangements available
A	60	Female	≥ 18 years	Communal bunk beds
B	100	Mixed	≥ 18 years	Communal bunk beds
C	45	Mixed	18 - 25 years	Communal floor mats and bunks beds
D	185	Mixed	All ages [+]	Private rooms / shared rooms / communal floor mats
E	70	Mixed	All ages [+]	Private rooms / shared rooms / communal floor mats
F	60	Male	≥ 18 years	Communal bunk beds
G	275	Mixed	≥ 18 years	Private rooms / shared rooms
H	275	Mixed	All ages [+]	Private rooms / shared rooms
I	45	Male	≥ 50 years	5 person dorms
J*	34	Male	≥ 18 years	Individual open cubicles
K**	75	Mixed	≥ 18 years	Individual open cubicles

[+]All ages= family shelter
[*]*Opened / data collection began 3 December 2020 to replace Shelter F*
[**] *Opened / data collection began 3 December 2020 to replace Shelter B*

Supplemental Table 1.2. Participant characteristics by COVID-19 case status

	COVID-19 + cases (n=22)*	COVID-19 - controls (n=44)*	Overall (N=66)
Age (years)†	45.0 [20.0, 66.0]	43.0 [18.0, 72.0]	44.0 [18.0, 72.0]
Sex (biological)			
Male	11 (50.0%)	22 (50.0%)	33 (50.0%)
Female	10 (45.5%)	20 (45.5%)	30 (45.5%)
Prefer not to say	1 (4.5%)	2 (4.5%)	3 (4.5%)
Hispanic ethnicity			
No	19 (86.4%)	35 (79.5%)	54 (81.8%)
Yes	2 (9.1%)	7 (15.9%)	9 (13.6%)
Prefer not to say	1 (4.5%)	2 (4.5%)	3 (4.5%)
Race			
American Indian or Alaska Native	1 (4.5%)	3 (6.8%)	4 (6.1%)
Asian	0 (0%)	3 (6.8%)	3 (4.5%)
Black or African American	10 (45.5%)	16 (36.4%)	26 (39.4%)
Native Hawaiian or other Pacific Islander	1 (4.5%)	3 (6.8%)	4 (6.1%)
White	4 (18.2%)	10 (22.7%)	14 (21.2%)
Multiple Races	2 (9.1%)	2 (4.5%)	4 (6.1%)
Other	2 (9.1%)	0 (0.0%)	2 (3.0%)
Prefer not to say	2 (9.1%)	7 (15.9%)	9 (13.6%)
Language			
English	19 (86.4%)	43 (97.7%)	62 (93.9%)
Spanish	2 (9.1%)	1 (2.3%)	3 (4.5%)
Tigrinya	1 (4.5%)	0 (0.0%)	1 (1.5%)
Education			
Less than high school graduate	4 (18.2%)	4 (9.1%)	8 (12.1%)
Graduated high school/obtained GED	7 (31.8%)	12 (27.3%)	19 (28.8%)
Some college‡	3 (13.6%)	14 (31.8%)	17 (25.8%)
Bachelor's or advanced degree	1 (4.5%)	13 (29.5%)	14 (21.2%)
Prefer not to say	1 (4.5%)	1 (2.3%)	2 (3.0%)
Missing	6 (27.3%)	0 (0%)	6 (9.1%)
Employed			
No	13 (59.1%)	23 (52.3%)	36 (54.5%)
Yes	3 (13.6%)	21 (47.7%)	24 (36.4%)
Missing	6 (27.3%)	0 (0%)	6 (9.1%)

	COVID-19 + cases (n=22)*	COVID-19 - controls (n=44)*	Overall (N=66)
Income			
≤ $25,000	10 (45.5%)	25 (56.8%)	35 (53.0%)
> $25,000	1 (4.5%)	11 (25.0%)	12 (18.2%)
Don't know or prefer not to say	5 (22.7%)	8 (18.2%)	13 (19.7%)
Missing	6 (27.3%)	0 (0.0%)	6 (9.1%)
Insurance			
Private	0 (0.0%)	11 (25.0%)	11 (16.7%)
Government	15 (68.2%)	24 (54.5%)	39 (59.1%)
None	0 (0.0%)	7 (15.9%)	7 (10.6%)
Prefer not to say	1 (4.5%)	2 (4.5%)	3 (4.5%)
Missing	6 (27.3%)	0 (0.0%)	6 (9.1%)
Duration of homelessness			
6 months or less	2 (9.1%)	10 (22.7%)	12 (18.2%)
7-12 months	1 (4.5%)	7 (15.9%)	8 (12.1%)
13-24 months	4 (18.2%)	3 (6.8%)	7 (10.6%)
Over 24 months (2 years)	8 (36.4%)	9 (20.5%)	17 (25.8%)
Prefer Not to Say	1 (4.5%)	2 (4.5%)	3 (4.5%)
Missing	6 (27.3%)	13 (29.5%)	19 (28.8%)
Shelter Type			
Mixed gender, ≥ 18 years	11 (50.0%)	16 (36.4%)	27 (40.9%)
Mixed gender, 18 - 25 years	0 (0.0%)	3 (6.8%)	3 (4.5%)
Female, ≥ 18 years	0 (0.0%)	4 (9.1%)	4 (6.1%)
Male, ≥ 18 years	2 (9.1%)	4 (9.1%)	6 (9.1%)
Male, ≥ 50 years	1 (4.5%)	3 (6.8%)	4 (6.1%)
Mixed gender, all ages	8 (36.4%)	14 (31.8%)	22 (33.3%)
Any comorbidities[§]	6 (27.3%)	13 (29.5%)	19 (28.8%)
Smoking status			
None	12 (54.5%)	26 (59.1%)	38 (57.6%)
Tobacco products	9 (40.9%)	16 (36.4%)	25 (37.9%)
Prefer not to say	1 (4.5%)	2 (4.5%)	3 (4.5%)
Any symptoms at baseline	5 (22.7%)	6 (13.6%)	11 (16.7%)
Follow-up time since enrollment (days)[†]	72.0 [35.0, 183]	157 [96.0, 223]	126 [35.0, 223]
Follow-up season[‖]			
Fall	1 (4.5%)	29 (65.9%)	30 (45.5%)

	COVID-19 + cases (n=22)*	COVID-19 - controls (n=44)*	Overall (N=66)
Spring	0 (0.0%)	15 (34.1%)	15 (22.7%)
Winter	3 (13.6%)	0 (0.0%)	3 (4.5%)
Summer	18 (81.8%)	0 (0.0%)	18 (27.3%)
Any symptoms at follow-up[a]	9 (40.9%)	12 (27.3%)	21 (31.8%)

* + = positive; - = negative

† Median [Min, Max]

‡ Some college includes: vocational training, associate's degree

§ Any comorbidities includes: asthma, blood disorders, cancer, chronic obstructive pulmonary disease or emphysema, immunosuppression, liver disease, heart disease, diabetes, neurologic conditions, or aspirin therapy.

ǁ Seasons defined by astronomical season in the Northern Hemisphere (using equinox and solstice dates)

[a] Any symptoms at follow-up represents a single follow-up time point between day 30-225 post-enrollment. If a COVID-19 case had more than one follow-up survey completed between day 30-225 post-enrollment, the survey from the median timepoint was selected and used.

Supplemental Table 1.3. Participant characteristics of COVID-19 cases: reached vs. unable to reach

	Reached (n=22)	Unable to reach (n=31)*
Age (years)†	45.0 [20.0, 66.0]	40.0 [19.0, 83.0]
Sex (biological)		
Male	11 (50.0%)	18 (58.1%)
Female	10 (45.5%)	11 (35.5%)
Prefer not to say	1 (4.5%)	2 (6.5%)
Hispanic ethnicity		
No	19 (86.4%)	28 (90.3%)
Yes	2 (9.1%)	1 (3.2%)
Prefer not to say	1 (4.5%)	2 (6.5%)
Race		
American Indian or Alaska Native	1 (4.5%)	3 (9.7%)
Asian	0 (0%)	0 (0.0%)
Black or African American	10 (45.5%)	15 (48.4%)
Native Hawaiian or other Pacific Islander	1 (4.5%)	0 (0.0%)
White	4 (18.2%)	5 (16.1%)
Multiracial	2 (9.1%)	3 (9.7%)
Other	2 (9.1%)	0 (0.0%)
Prefer not to say	2 (9.1%)	5 (16.1%)
Language		
English	19 (86.4%)	28 (90.3%)
Spanish	2 (9.1%)	0 (0.0%)
Other	1 (4.5%)	3 (9.6%)
Education		
Less than high school graduate	4 (18.2%)	7 (22.6%)
Graduated high school/obtained GED	7 (31.8%)	7 (22.6%)
Some college‡	3 (13.6%)	6 (19.4%)
Bachelor's or advanced degree	1 (4.5%)	2 (6.5%)
Prefer not to say	1 (4.5%)	3 (9.7%)
Missing	6 (27.3%)	6 (19.4%)
Employed		
No	13 (59.1%)	19 (61.3%)
Yes	3 (13.6%)	5 (16.1%)
Missing	6 (27.3%)	7 (22.6%)

	Reached (n=22)	Unable to reach (n=31)*
Income		
≤ $25,000	10 (45.5%)	11 (35.5%)
> $25,000	1 (4.5%)	2 (6.5%)
Don't know or prefer not to say	5 (22.7%)	12 (38.7%)
Missing	6 (27.3%)	6 (19.4%)
Insurance		
Private	0 (0.0%)	2 (6.5%)
Government	15 (68.2%)	19 (61.3%)
None	0 (0.0%)	1 (3.2%)
Prefer not to say	1 (4.5%)	2 (6.5%)
Missing	6 (27.3%)	7 (22.6%)
Duration of homelessness		
6 months or less	2 (9.1%)	6 (19.4%)
7-12 months	1 (4.5%)	0 (0.0%)
13-24 months	4 (18.2%)	3 (9.7%)
Over 24 months (2 years)	8 (36.4%)	10 (32.3%)
Prefer Not to Say	1 (4.5%)	3 (9.7%)
Missing	6 (27.3%)	9 (29.0%)
Shelter Type		
Mixed gender, ≥ 18 years	11 (50.0%)	19 (61.3%)
Mixed gender, 18 - 25 years	0 (0.0%)	1 (3.2%)
Female, ≥ 18 years	0 (0.0%)	2 (6.5%)
Male, ≥ 18 years	2 (9.1%)	2 (6.5%)
Male, ≥ 50 years	1 (4.5%)	0 (0.0%)
Mixed gender, all ages	8 (36.4%)	7 (22.6%)
Any comorbidities[§]	6 (27.3%)	4 (22.6%)
Smoking status		
None	12 (54.5%)	12 (38.7%)
Tobacco products or electronic cigarettes	9 (40.9%)	15 (48.4%)
Prefer not to say	1 (4.5%)	2 (6.5%)
Any symptoms at enrollment	5 (22.7%)	7 (22.6%)
Any phone number provided	17 (77.3%)	15 (48.4%)

* Cases in “Unable to reach (n=31)” include those who were deceased (n=1), declined to participate (n=8), and unable to reach (n=22)
† Median [Min, Max]
‡ Some college includes: vocational training, associate's degree

§ Any comorbidities includes: asthma, blood disorders, cancer, chronic obstructive pulmonary disease or emphysema, immunosuppression, liver disease, heart disease, diabetes, neurologic conditions, or aspirin therapy.

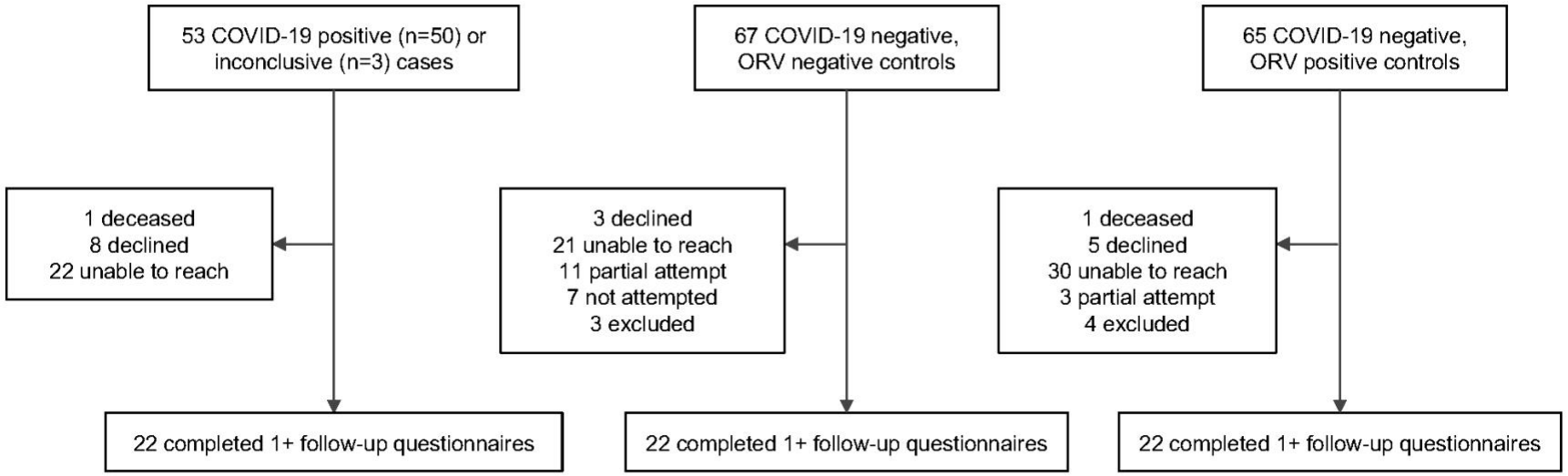
Supplemental Table 1.4. Participant characteristics of COVID-19 controls: reached vs. unable to reach

	Reached (n=44)	Unable to reach (n=60)*
Age (years)†	43.0 [18.0, 72.0]	43.0 [19.0, 71.0]
Sex (biological)		
Male	22 (50.0%)	36 (60.0%)
Female	20 (45.5%)	23 (38.3%)
Prefer not to say	2 (4.5%)	1 (1.7%)
Hispanic ethnicity		
No	35 (79.5%)	48 (80.0%)
Yes	7 (15.9%)	10 (16.7%)
Prefer not to say	2 (4.5%)	2 (3.3%)
Race		
American Indian or Alaska Native	3 (6.8%)	3 (5.0%)
Asian	3 (6.8%)	2 (3.3%)
Black or African American	16 (36.4%)	20 (33.3%)
Native Hawaiian or other Pacific Islander	3 (6.8%)	4 (6.7%)
White	10 (22.7%)	16 (26.7%)
Multiracial	2 (4.5%)	4 (6.7%)
Other	0 (0.0%)	0 (0.0%)
Prefer not to say	7 (15.9%)	11 (18.3%)
Language		
English	43 (97.7%)	56 (93.3%)
Spanish	1 (2.3%)	3 (5.0%)
Other	0 (0.0%)	1 (1.7%)
Education		
Less than high school graduate	4 (9.1%)	13 (21.7%)
Graduated high school/obtained GED	12 (27.3%)	15 (25.0%)
Some college‡	14 (31.8%)	22 (36.7%)
Bachelor's or advanced degree	13 (29.5%)	7 (11.7%)
Prefer not to say	1 (2.3%)	3 (5.0%)
Employed		
No	23 (52.3%)	44 (73.3%)
Yes	21 (47.7%)	16 (26.7%)
Income		

	Reached (n=44)	Unable to reach (n=60)*
≤ $25,000	25 (56.8%)	38 (63.3%)
> $25,000	11 (25.0%)	6 (10.0%)
Don't know or prefer not to say	8 (18.2%)	16 (26.7%)
Insurance		
Private	11 (25.0%)	7 (11.7%)
Government	24 (54.5%)	43 (71.7%)
None	7 (15.9%)	9 (15.0%)
Prefer not to say	2 (4.5%)	1 (1.7%)
Duration of homelessness		
6 months or less	10 (22.7%)	15 (25.0%)
7-12 months	7 (15.9%)	7 (11.7%)
13-24 months	3 (6.8%)	9 (15.0%)
Over 24 months (2 years)	9 (20.5%)	16 (26.7%)
Prefer Not to Say	2 (4.5%)	1 (1.7%)
Missing	13 (29.5%)	12 (20.0%)
Shelter Type		
Mixed gender, ≥ 18 years	16 (36.4%)	25 (41.7%)
Mixed gender, 18 - 25 years	3 (6.8%)	3 (5.0%)
Female, ≥ 18 years	4 (9.1%)	3 (5.0%)
Male, ≥ 18 years	4 (9.1%)	4 (6.7%)
Male, ≥ 50 years	3 (6.8%)	3 (5.0%)
Mixed gender, all ages	14 (31.8%)	22 (36.7%)
Any comorbidities[§]	13 (29.5%)	16 (26.7%)
Smoking status		
None	26 (59.1%)	28 (46.7%)
Tobacco products or electronic cigarettes	16 (36.4%)	31 (51.7%)
Prefer not to say	2 (4.5%)	1 (1.7%)
Any symptoms at enrollment	6 (13.6%)	7 (11.7%)
Any phone number provided	44 (100%)	60 (100%)

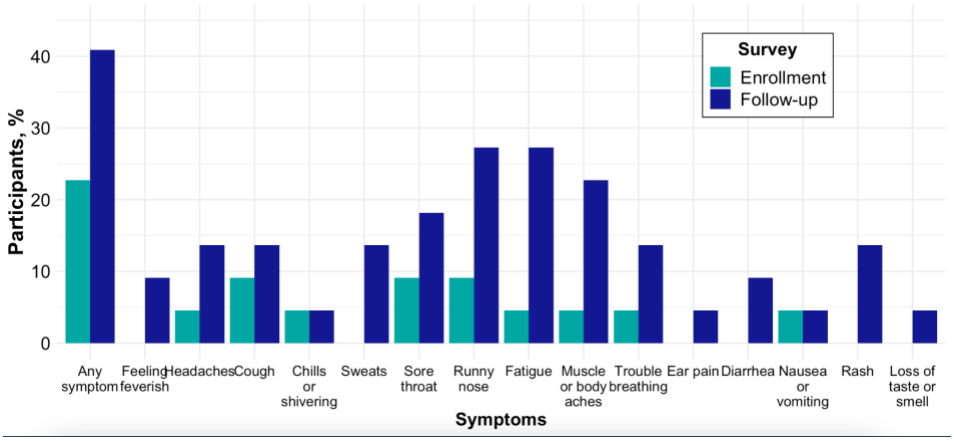
* Controls in “Unable to reach (n=60)” include those who were deceased (n=1), declined to participate (n=8), and unable to reach (n=51)
† Median [Min, Max]
‡ Some college includes: vocational training, associate's degree
§ Any comorbidities includes: asthma, blood disorders, cancer, chronic obstructive pulmonary disease or emphysema, immunosuppression, liver disease, heart disease, diabetes, neurologic conditions, or aspirin therapy

Supplemental Figure 1.1. Study flow diagram

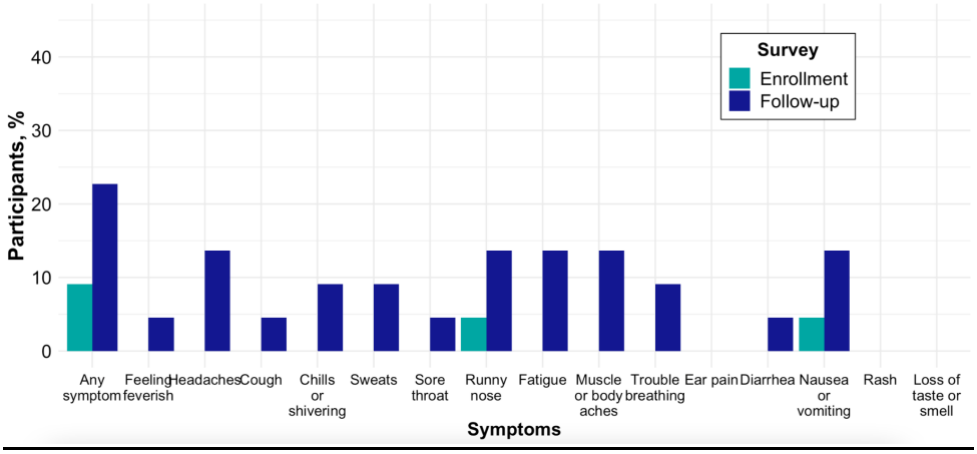


Supplemental Figure 1.2. Symptoms reported at enrollment and follow-up by COVID-19 and Other Respiratory Virus (ORV) case status

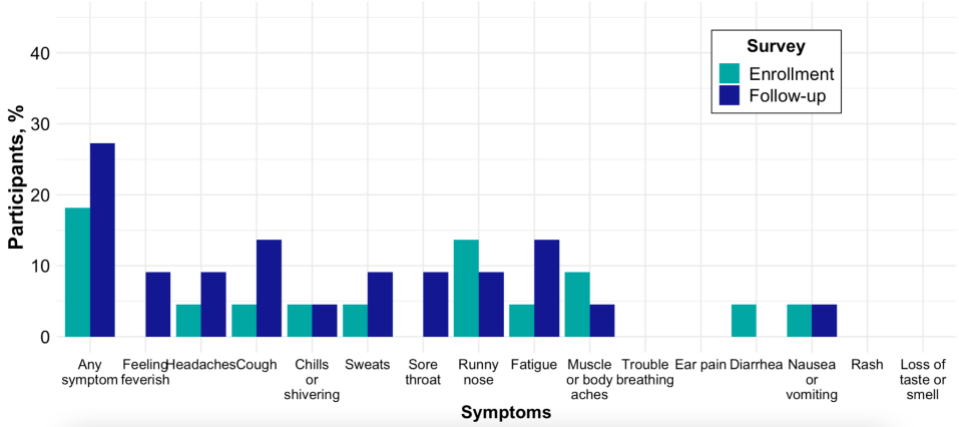
COVID-19-positive cases



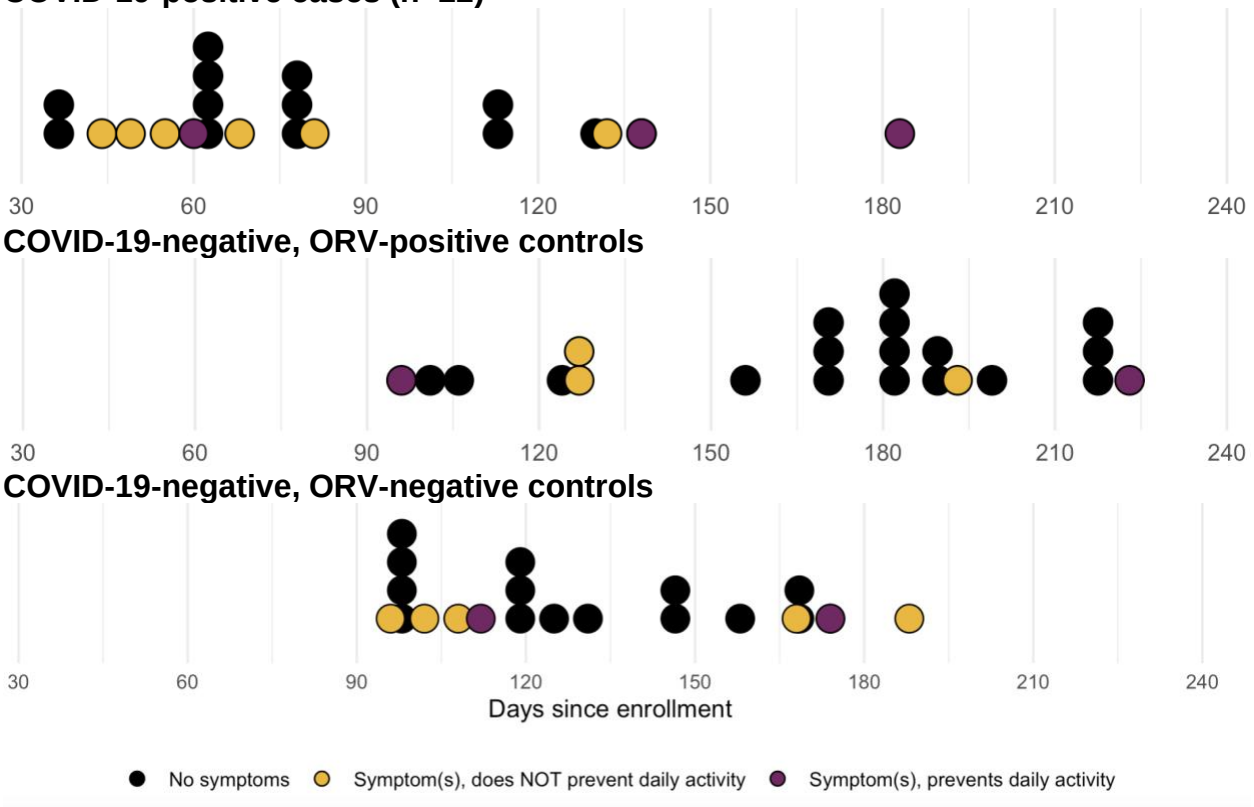
COVID-19-negative, ORV-positive controls



COVID-19-negative, ORV-negative controls



Supplemental Figure 1.3. Dot plot of symptoms and impact on daily activity at follow-up by COVID-19 case status



Appendix 1.2. Enrollment Questionnaire

0. Date and Time: MM/DD/YYYY HH:MM [AM/PM]

1. Shelter location: _____

2. Are you a shelter staff member?
    - Yes
    - No

3. What is your preferred language for your study participation?
    - English
    - Spanish
    - Amharic
    - Tigrinya
    - Ngala
    - Marshallese
    - Other, please specify: _____

4. Enter your birthday: MM/DD/YYYY

5. Enter your phone number: _____

6. Have you experienced any of these new or worsening symptoms in the last seven days?* Select all that apply.
    - Feeling feverish
    - Headaches
    - Cough
    - Chills or shivering
    - Sweats
    - Sore throat or itchy/scratchy throat
    - Runny / stuffy nose
    - Feeling more tired than usual
    - Muscle or body aches
    - Increased trouble with breathing
    - Ear pain or ear discharge
    - Diarrhea
    - Nausea or vomiting
    - Rash
    - Loss of smell or taste
    - None of the above →*Skip to question 11*

*NOTE: We want to know if you have NEW or WORSE health problems. For example, some people always cough and we want to know if and when your cough GOT WORSE.

7. When did these symptoms you listed become new or worsening?
    - Half a day ago
    - Half a day - 1 day ago
    - 1 - 1.5 days ago
    - 1.5 - 2 days ago
    - 3 days ago
    - 4 days ago
    - 5 or more days ago
    - I don't have any new or worsening symptoms →*Skip to question 11*

8. How severe are your symptoms? Select the level of discomfort you felt at the worst point.
    a) Feeling feverish
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization
    b) Headaches
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization
    c) Cough
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization
    d) Chills or shivering
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization
    e) Sweats
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization
    f) Sore throat or itchy/scratchy throat
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)

- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

g) Runny/stuffy nose
   - Mild (does not interfere with activity)
   - Moderate (interferes with daily activity)
   - Severe (prevents daily activity)
   - Requiring emergency department visit or hospitalization

h) Feeling more tired than usual
   - Mild (does not interfere with activity)
   - Moderate (interferes with daily activity)
   - Severe (prevents daily activity)
   - Requiring emergency department visit or hospitalization

i) Muscle or body aches
   - Mild (does not interfere with activity)
   - Moderate (interferes with daily activity)
   - Severe (prevents daily activity)
   - Requiring emergency department visit or hospitalization

j) Increase trouble with breathing
   - Mild (does not interfere with activity)
   - Moderate (interferes with daily activity)
   - Severe (prevents daily activity)
   - Requiring emergency department visit or hospitalization

k) Ear pain or ear discharge
   - Mild (does not interfere with activity)
   - Moderate (interferes with daily activity)
   - Severe (prevents daily activity)
   - Requiring emergency department visit or hospitalization

l) Diarrhea
   - Mild (does not interfere with activity)
   - Moderate (interferes with daily activity)
   - Severe (prevents daily activity)
   - Requiring emergency department visit or hospitalization

m) Nausea or vomiting
   - Mild (does not interfere with activity)
   - Moderate (interferes with daily activity)
   - Severe (prevents daily activity)
   - Requiring emergency department visit or hospitalization

n) Rash
   - Mild (does not interfere with activity)
   - Moderate (interferes with daily activity)
   - Severe (prevents daily activity)
   - Requiring emergency department visit or hospitalization

o) Loss of smell or taste
    - Mild (does not interfere with activity)
    - Moderate (interferes with daily activity)
    - Severe (prevents daily activity)
    - Requiring emergency department visit or hospitalization

9. When your recent illness was at its worst, how did it affect your ability to do your regular activities (work, school, etc.)?
    - Not at all
    - A little bit
    - Somewhat
    - Quite a bit
    - Very much

10. Which of the following daily activities have been impacted by your current illness? Select all that apply.
    - Work
    - School
    - Running errands
    - Exercising
    - Socializing
    - Looking for work
    - Ability to take care of myself and/or family
    - None of the above/ my activities have not been impacted
    - Prefer not to say

11. Have you previously been tested for COVID-19?
    - Yes
    - No →*Skip to question 14*

12. Have you ever tested positive for COVID-19?
    - Yes
    - No →*Skip to question 14*

13. What was the date of your most recent positive COVID-19 swab test?
    - MM/DD/YYYY

14. What is your sex?
    - Male
    - Female

- Other, please specify: _____
- Prefer not to say

15. Are you Hispanic or Latino?
    - Yes
    - No
    - Prefer not to say

16. How would you describe your race? Select all that apply.
    - American Indian or Alaska Native
    - Asian
    - Native Hawaiian or other Pacific Islander
    - Black or African American
    - White
    - Other
    - Prefer not to say

17. Have you ever been told by a healthcare provider that you have one of the following medical conditions? Select all that apply.
    - Asthma or reactive airway disease
    - Blood disorders (e.g., sickle cell)
    - COPD/ emphysema
    - Chronic bronchitis
    - Cancer
    - Diabetes
    - Heart disease (heart failure or heart attack)
    - Immunosuppression (by medication or disease)
    - Liver disease
    - None of these conditions
    - Do not know
    - Prefer not to say

18. What is the highest level of education you have completed?
    - Less than high school graduate
    - Graduated high school/obtained GED
    - Some college (including vocational training, associate's degree)
    - Bachelor's degree
    - Advanced degree
    - Prefer not to say

19. Please choose the range that best represents your household income last year (before taxes). If you are still considered a "dependent" for tax purposes, choose the range that describes your parent/legal guardian's household income.
    - Less than or equal to $25,000
    - Between $25 and 50 thousand ($25,001 to $50,000)
    - Between $50 and 75 thousand ($50,001 to $75,000)
    - Between $75 and 100 thousand ($75,001 to$100,000)
    - Between $100 and 125 thousand ($100,001 to$125,000)
    - Between $125 and 150 thousand ($125,001 to$150,000)
    - Over $150,000
    - Don't know
    - Prefer not to say

20. What type of health insurance do you have? Select all that apply.
    - Private (provided by employer and/or purchased)
    - Government (Medicare/Medicaid)
    - Other
    - None
    - Prefer not to say

21. How long have you been experiencing homelessness? We consider homelessness to be living without permanent housing (which may include staying with friends, in a hotel, shelter, church, on the streets, in a car, or in any other unstable or non-permanent situation).
    - 6 months or less
    - 7-12 months
    - 13-24 months
    - Over 24 months (2 years)
    - Do Not Know
    - Prefer Not to Say

22. Are you currently employed?
    - Yes
    - No

23. Do you use any of the following products (either indoors or outdoors)? Select all that apply.
    - Tobacco products (e.g. cigarettes, cigars, pipes)
    - Electronic cigarettes/vapor pens
    - None of the above
    - Prefer not to say

Appendix 1.3. COVID-19 Case Follow-up Questionnaire

0. Date and Time: MM/DD/YYYY HH:MM [AM/PM]

1. In the last seven days, have you experienced any of the following symptoms that were new or worsening symptoms since [enrollment date]?* Select all that apply.
    - Feeling feverish
    - Headaches
    - Cough
    - Chills or shivering
    - Sweats
    - Sore throat or itchy/scratchy throat
    - Runny / stuffy nose
    - Feeling more tired than usual
    - Muscle or body aches
    - Increased trouble with breathing
    - Ear pain or ear discharge
    - Diarrhea
    - Nausea or vomiting
    - Rash
    - Loss of smell or taste
    - None of the above →*Skip to question 4*

    **NOTE: on day 5 survey modify to* "Have you experienced any of the following new or worsening symptoms since [enrollment date]?"

2. When did these symptoms you listed become new or worsening?
    - Half a day ago
    - Half a day - 1 day ago
    - 1 - 1.5 days ago
    - 1.5 - 2 days ago
    - 3 days ago
    - 4 days ago
    - 5 or more days ago
    - I don't have any new or worsening symptoms →*Skip to question 4*

3. How severe have your symptoms been in the last seven days?* Select the level of discomfort you felt at the worst point.

    **NOTE: on day 5 survey modify to* "How severe have your symptoms been since [enrollment date]? Select the level of discomfort you felt at the worst point."

    p) Feeling feverish
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)

- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

q) Headaches
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

r) Cough
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

s) Chills or shivering
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

t) Sweats
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

u) Sore throat or itchy/scratchy throat
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

v) Runny/stuffy nose
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

w) Feeling more tired than usual
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

x) Muscle or body aches
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

y) Increase trouble with breathing
    - Mild (does not interfere with activity)
    - Moderate (interferes with daily activity)
    - Severe (prevents daily activity)
    - Requiring emergency department visit or hospitalization

z) Ear pain or ear discharge
    - Mild (does not interfere with activity)
    - Moderate (interferes with daily activity)
    - Severe (prevents daily activity)
    - Requiring emergency department visit or hospitalization

aa) Diarrhea
    - Mild (does not interfere with activity)
    - Moderate (interferes with daily activity)
    - Severe (prevents daily activity)
    - Requiring emergency department visit or hospitalization

bb) Nausea or vomiting
    - Mild (does not interfere with activity)
    - Moderate (interferes with daily activity)
    - Severe (prevents daily activity)
    - Requiring emergency department visit or hospitalization

cc) Rash
    - Mild (does not interfere with activity)
    - Moderate (interferes with daily activity)
    - Severe (prevents daily activity)
    - Requiring emergency department visit or hospitalization

dd) Loss of smell or taste
    - Mild (does not interfere with activity)
    - Moderate (interferes with daily activity)
    - Severe (prevents daily activity)
    - Requiring emergency department visit or hospitalization

4. Since [enrollment date] have you newly required supplemental oxygen related to your COVID-19 illness?
    - No
    - Yes and I continue to need supplemental oxygen
    - Yes, but I don't need it anymore

5. Thinking about your symptoms in the last seven* days, do you feel better, as sick, or worse than when you were diagnosed with COVID-19 on [enrollment date]?
    - Better
    - As sick
    - Worse

NOTE: on day 5 survey modify to “Thinking about your symptoms in the last **five** days, do you feel better, as sick, or worse than when you were diagnosed with COVID-19 on [enrollment date]?”

6. How has your positive (or inconclusive) COVID-19 test result affected your ability to do your regular activities (work, school, etc.)?
    - Not at all
    - A little bit
    - Somewhat
    - Quite a bit
    - Very much

7. Which of the following daily activities have been affected by your positive (or inconclusive) COVID-19 test result so far? Select all that apply.
    - Work
    - School
    - Running errands
    - Exercising
    - Socializing
    - Looking for work
    - Ability to take care of myself and/or family
    - Accessing overnight shelter services
    - Accessing other services (housing, laundry, food, case management)
    - None of the above/ my activities have not been impacted
    - Prefer not to say

8. Did any of the following occur in the last week because of your positive (or inconclusive) COVID-19 test result? Select all that apply.
    - I missed work → *If selected, continue to Question 9. If not selected, skip to question 10.*
    - I worked from home
    - I worked fewer hours than usual.
    - I lost my job
    - None of the above

9. How many days were you not able to go to work?

10. Did your positive (or inconclusive) COVID-19 test result keep you from doing any of the following? Select all that apply.
    - Attending class

- Going to work
- Studying
- Performing well on an exam or written assignment
- None of the above/ My activities have not been impacted

11. Have you received any clinical care related to your COVID-19 illness since testing positive (or inconclusive)? Select all that apply.
    - Yes - Doctor's Office or Urgent Care
    - Yes - Pharmacy (drugstore)
    - Yes - Emergency Department
    - Yes - Hospital (admitted)
    - Yes - A provider in Isolation & Quarantine
    - Yes - Via phone or telehealth visit
    - Yes - Other
    - None → *If selected, skip to question 13*

12. How long ago was your most recent medical visit for your COVID-19 illness?
    - Less than seven days ago
    - 7-15 days ago
    - More than 15 days ago

13. To the researcher: has the participant completed the day 5 QoL questions?
    - No → *If selected, say the following statement and continue to question 14.*
        - "The next questions are about your quality of life related to your health. We will ask you these questions two times-- first about your current health and quality of life, then about your health and quality of life prior to your COVID-19 illness. First, please answer these questions about your current health."
    - Yes → *If selected, say the following statement, continue to question 14, and skip questions 23-31.*
        - "The next questions are about your quality of life related to your current health."

14. Would you say that in general your health is:
    - Excellent
    - Very good
    - Good
    - Fair
    - Poor
    - Don't know/ not sure
    - Refused

15. Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health NOT good?
    - Number 1-30
    - None
    - Don't know/Not sure
    - Refused

16. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health NOT good?
    - Number 1-30
    - None
    - Don't know/Not sure
    - Refused

17. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities such as self-care, work, or recreation?
    - Number 1-30
    - None
    - Don't know/Not sure
    - Refused

18. These next questions are about physical, mental, or emotional problems or limitations you may have in your daily life. Are you LIMITED in any way in any activities because of any impairment or health problem?
    - Yes
    - No □*If selected, skip to question 23*
    - Don't know/Not sure □*If selected, skip to question 23*
    - Refused□*If selected, skip to question 23*

19. What is the MAJOR impairment or health problem that limits your activities? (*DO NOT READ OPTIONS. Code only one category that represents the major impairment.*)
    - Arthritis/rheumatism
    - Back or neck problem
    - Fractures, bone/joint injury
    - Walking problem
    - Lung/breathing problem
    - Hearing problem
    - Eye/vision problem
    - Heart problem

- Stroke problem
- Hypertension/high blood pressure
- Diabetes
- Cancer
- Depression/anxiety/emotional problem
- Other impairment/problem
- Don't know/Not sure
- Refused

20. For HOW LONG have your activities been limited because of your major impairment or health problem? (*Do Not Read Options. Code using respondent's unit of time.*)
    - Days
    - Weeks
    - Months
    - Years
    - Don’t know/Not sure
    - Refused

21. Because of any impairment or health problem, do you need the help of other persons with your PERSONAL CARE needs, such as eating, bathing, dressing, or getting around the house?
    - Yes
    - No
    - Don’t know/Not sure
    - Refused

22. Because of any impairment or health problem, do you need the help of other persons in handling your ROUTINE needs, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes?
    - Yes
    - No
    - Don’t know/Not sure
    - Refused

23. We are now going to repeat the same health and quality of life questions. This time, please think and respond about your health prior to your COVID-19 illness. Would you say that in general your health (prior to COVID-19 illness) was:
    - Excellent
    - Very good
    - Good
    - Fair

- Poor
- Don’t know/ not sure
- Refused

24. Now thinking about your physical health, which includes physical illness and injury, for how many days during the 30 days prior to your COVID-19 diagnosis on [enrollment date] was your physical health NOT good?
    - Number 1-30
    - None
    - Don’t know/Not sure
    - Refused

25. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the 30 days prior to your COVID-19 diagnosis on [enrollment date] was your mental health NOT good?
    - Number 1-30
    - None
    - Don’t know/Not sure
    - Refused

26. During the 30 days prior to your COVID-19 diagnosis on [enrollment date], for about how many days did poor physical or mental health keep you from doing your usual activities such as self-care, work, or recreation?
    - Number 1-30
    - None
    - Don’t know/Not sure
    - Refused

27. These next questions are about physical, mental, or emotional problems or limitations you may have in your daily life. Prior to your COVID-19 illness, were you LIMITED in any way in any activities because of any impairment or health problem?
    - Yes
    - No *If selected, skip to question 32*
    - Don't know/Not sure *If selected, skip to question 32*
    - Refused *If selected, skip to question 32*

28. What is the MAJOR impairment or health problem that limited your activities? (*DO NOT READ OPTIONS. Code only one category that represents the major impairment.*)
    - Arthritis/rheumatism
    - Back or neck problem
    - Fractures, bone/joint injury

- Walking problem
- Lung/breathing problem
- Hearing problem
- Eye/vision problem
- Heart problem
- Stroke problem
- Hypertension/high blood pressure
- Diabetes
- Cancer
- Depression/anxiety/emotional problem
- Other impairment/problem
- Don't know/Not sure
- Refused

29. For HOW LONG had your activities been limited because of your major impairment or health problem? (*Do Not Read Options. Code using respondent's unit of time*.)
    - Days
    - Weeks
    - Months
    - Years
    - Don’t know/Not sure
    - Refused

30. Because of any impairment or health problem, did you need the help of other persons with your PERSONAL CARE needs, such as eating, bathing, dressing, or getting around the house?
    - Yes
    - No
    - Don’t know/Not sure
    - Refused

31. Because of any impairment or health problem, did you need the help of other persons in handling your ROUTINE needs, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes?
    - Yes
    - No
    - Don’t know/Not sure
    - Refused

NOTE: Questions 32 and 33 were asked on day 5-10 surveys only

32. At what Isolation & Quarantine facility are you currently?
33. How many days have you been in Isolation & Quarantine?
    - 0-3 days
    - 4-7 days
    - >7 days

Appendix 1.4. COVID-19 Control Follow-up Questionnaire

BEFORE STARTING SURVEY: Have you tested positive for the virus that causes COVID-19 since [enrollment date]?

- No
- Yes →If selected, DO NOT COMPLETE SURVEY AS INELIGIBLE TO BE A CONTROL

0. Date and Time: MM/DD/YYYY HH:MM [AM/PM]

1. In the last seven days, have you experienced any of the following symptoms that were new or worsening symptoms since [enrollment date]?* Select all that apply.
   - Feeling feverish
   - Headaches
   - Cough
   - Chills or shivering
   - Sweats
   - Sore throat or itchy/scratchy throat
   - Runny / stuffy nose
   - Feeling more tired than usual
   - Muscle or body aches
   - Increased trouble with breathing
   - Ear pain or ear discharge
   - Diarrhea
   - Nausea or vomiting
   - Rash
   - Loss of smell or taste
   - None of the above→*Skip to question 4*

   **NOTE: on day 5 survey modify to* "Have you experienced any of the following new or worsening symptoms since [enrollment date]?"

2. When did these symptoms you listed become new or worsening?
   - Half a day ago
   - Half a day - 1 day ago
   - 1 - 1.5 days ago
   - 1.5 - 2 days ago
   - 3 days ago
   - 4 days ago
   - 5 or more days ago
   - I don't have any new or worsening symptoms →*Skip to question 4*

3. How severe have your symptoms been in the last seven days?* Select the level of discomfort you felt at the worst point.
    ee) Feeling feverish
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization

    ff) Headaches
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization

    gg) Cough
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization

    hh) Chills or shivering
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization

    ii) Sweats
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization

    jj) Sore throat or itchy/scratchy throat
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization

    kk) Runny/stuffy nose
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization

    ll) Feeling more tired than usual
        - Mild (does not interfere with activity)
        - Moderate (interferes with daily activity)
        - Severe (prevents daily activity)
        - Requiring emergency department visit or hospitalization

    mm) Muscle or body aches

- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

nn) Increase trouble with breathing
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

oo) Ear pain or ear discharge
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

pp) Diarrhea
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

qq) Nausea or vomiting
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

rr) Rash
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

ss) Loss of smell or taste
- Mild (does not interfere with activity)
- Moderate (interferes with daily activity)
- Severe (prevents daily activity)
- Requiring emergency department visit or hospitalization

4. Since [enrollment date] have you newly required supplemental oxygen?
   - No
   - Yes and I continue to need supplemental oxygen
   - Yes, but I don't need it anymore

5. Thinking about your symptoms in the last seven* days, do you feel better, as sick, or worse than when you were tested for COVID-19 on [enrollment date]?

- Better
- As sick
- Worse

6. Have the symptoms you mentioned above affected your ability to do your regular activities (work, school, etc.)?
    - Not at all
    - A little bit
    - Somewhat
    - Quite a bit
    - Very much

7. Which of the following daily activities have been affected so far? Select all that apply.
    - Work
    - School
    - Running errands
    - Exercising
    - Socializing
    - Looking for work
    - Ability to take care of myself and/or family
    - Accessing overnight shelter services
    - Accessing other services (housing, laundry, food, case management)
    - None of the above/ my activities have not been impacted
    - Prefer not to say

8. Did any of the following occur in the last week because of your symptoms? Select all that apply.
    - I missed work → *If selected, continue to Question 9. If not selected, skip to question 10.*
    - I worked from home
    - I worked fewer hours than usual.
    - I lost my job
    - None of the above

9. How many days were you not able to go to work?

10. Did your symptoms keep you from doing any of the following? Select all that apply.
    - Attending class
    - Going to work
    - Studying
    - Performing well on an exam or written assignment

- None of the above/ My activities have not been impacted

11. Have you received any clinical care related to your symptoms since [enrollment date]? Select all that apply.
    - Yes - Doctor's Office or Urgent Care
    - Yes - Pharmacy (drugstore)
    - Yes - Emergency Department
    - Yes - Hospital (admitted)
    - Yes - A provider in Isolation & Quarantine
    - Yes - Via phone or telehealth visit
    - Yes - Other
    - None → *If selected, skip to question 13*

12. How long ago was your most recent medical visit for your symptoms?
    - Less than seven days ago
    - 7-15 days ago
    - More than 15 days ago

13. The next questions are about your quality of life related to your health. We will ask you these questions two times-- first about your current health and quality of life, then about your health and quality of life prior to [enrollment date] when you were tested for COVID-19 through our study. First, please answer these questions about your current health.

14. Would you say that in general your health is:
    - Excellent
    - Very good
    - Good
    - Fair
    - Poor
    - Don’t know/ not sure
    - Refused

15. Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health NOT good?
    - Number 1-30
    - None
    - Don’t know/Not sure
    - Refused

16. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health NOT good?
    - Number 1-30
    - None
    - Don't know/Not sure
    - Refused

17. During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities such as self-care, work, or recreation?
    - Number 1-30
    - None
    - Don't know/Not sure
    - Refused

18. These next questions are about physical, mental, or emotional problems or limitations you may have in your daily life. Are you LIMITED in any way in any activities because of any impairment or health problem?
    - Yes
    - No *→If selected, skip to question 23*
    - Don't know/Not sure *→If selected, skip to question 23*
    - Refused *→If selected, skip to question 23*

19. What is the MAJOR impairment or health problem that limits your activities? (*DO NOT READ OPTIONS. Code only one category that represents the major impairment.*)
    - Arthritis/rheumatism
    - Back or neck problem
    - Fractures, bone/joint injury
    - Walking problem
    - Lung/breathing problem
    - Hearing problem
    - Eye/vision problem
    - Heart problem
    - Stroke problem
    - Hypertension/high blood pressure
    - Diabetes
    - Cancer
    - Depression/anxiety/emotional problem
    - Other impairment/problem
    - Don't know/Not sure
    - Refused

20. For HOW LONG have your activities been limited because of your major impairment or health problem? (*Do Not Read Options. Code using respondent's unit of time*.)
    - Days
    - Weeks
    - Months
    - Years
    - Don’t know/Not sure
    - Refused

21. Because of any impairment or health problem, do you need the help of other persons with your PERSONAL CARE needs, such as eating, bathing, dressing, or getting around the house?
    - Yes
    - No
    - Don’t know/Not sure
    - Refused

22. Because of any impairment or health problem, do you need the help of other persons in handling your ROUTINE needs, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes?
    - Yes
    - No
    - Don’t know/Not sure
    - Refused

23. We are now going to repeat the same health and quality of life questions. This time, please think and respond about your health prior to when you were tested for COVID-19 through our study on [enrollment date]. Would you say that in general your health (prior to [enrollment date]) was:
    - Excellent
    - Very good
    - Good
    - Fair
    - Poor
    - Don’t know/ not sure
    - Refused

24. Now thinking about your physical health, which includes physical illness and injury, for how many days during the 30 days prior to [enrollment date] was your physical health NOT good?

- Number 1-30
- None
- Don’t know/Not sure
- Refused

25. Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the 30 days prior to [enrollment date] was your mental health NOT good?
    - Number 1-30
    - None
    - Don’t know/Not sure
    - Refused

26. During the 30 days prior to [enrollment date], for about how many days did poor physical or mental health keep you from doing your usual activities such as self-care, work, or recreation?
    - Number 1-30
    - None
    - Don’t know/Not sure
    - Refused

27. These next questions are about physical, mental, or emotional problems or limitations you may have in your daily life. Prior to [enrollment date], were you LIMITED in any way in any activities because of any impairment or health problem?
    - Yes
    - No →*If selected, skip to question 32*
    - Don't know/Not sure →*If selected, skip to question 32*
    - Refused →*If selected, skip to question 32*

28. What is the MAJOR impairment or health problem that limited your activities? (*DO NOT READ OPTIONS. Code only one category that represents the major impairment.*)
    - Arthritis/rheumatism
    - Back or neck problem
    - Fractures, bone/joint injury
    - Walking problem
    - Lung/breathing problem
    - Hearing problem
    - Eye/vision problem
    - Heart problem
    - Stroke problem
    - Hypertension/high blood pressure

- Diabetes
- Cancer
- Depression/anxiety/emotional problem
- Other impairment/problem
- Don't know/Not sure
- Refused

29. For HOW LONG had your activities been limited because of your major impairment or health problem? (*Do Not Read Options. Code using respondent's unit of time.*)
    - Days
    - Weeks
    - Months
    - Years
    - Don’t know/Not sure
    - Refused

30. Because of any impairment or health problem, did you need the help of other persons with your PERSONAL CARE needs, such as eating, bathing, dressing, or getting around the house?
    - Yes
    - No
    - Don’t know/Not sure
    - Refused

31. Because of any impairment or health problem, did you need the help of other persons in handling your ROUTINE needs, such as everyday household chores, doing necessary business, shopping, or getting around for other purposes?
    - Yes
    - No
    - Don’t know/Not sure
    - Refused

CHAPTER 2A. TRENDS AND FACTORS ASSOCIATED WITH CHANGE IN COVID-19 VACCINATION INTENT AMONG RESIDENTS AND STAFF IN SIX SEATTLE HOMELESS SHELTERS, MARCH 2020 TO AUGUST 2021

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Preface

This Chapter contains a manuscript published in the journal Vaccine: X (19 October 2022).[72]

Abstract

Introduction: Achieving high COVID-19 vaccination coverage in homeless shelters is critical in preventing morbidity, mortality, and outbreaks, however, vaccination coverage remains lower among people experiencing homelessness (PEH) than the general population.

Methods: We conducted a cross-sectional study to retrospectively describe attitudes and identify factors associated with change in COVID-19 vaccination intent among shelter residents and staff during March 2020 - August 2021. To identify factors associated with change in COVID-19 vaccine intent becoming more positive overall compared to other attitudes, we utilized a Poisson model to calculate Risk Ratios with robust standard errors, adjusting for confounding by shelter site and demographic variables determined *a priori.*

Results: From July 12 - August 2, 2021, 97 residents and 20 staff participated in surveys across six shelters in Seattle King County, Washington. Intent to be vaccinated against COVID-19 increased from 45.3% (n = 53) when recalling attitudes in March 2020 to 74.4% (n = 87) as of August 2021, and was similar among residents and staff. Many participants (43.6%, n = 51) indicated feeling increasingly accepting about receiving a COVID-19 vaccine since March 2020, while 13.7% (n = 16) changed back and forth, 10.3% (n = 12) became more hesitant, and 32.5% (n = 38) had no change in intent. In the model examining the relationship between becoming more positive about receiving a COVID-19 vaccine compared to all other attitudes (n = 116), we found a 57.2% increase in vaccine acceptability (RR 1.57; 95% CI: 1.01, 2.45) among those who reported worsening mental health since the start of the pandemic.

Conclusions: Findings highlight opportunities to improve communication with residents and staff about COVID-19 vaccination and support a need for continued dialogue and a person-centered approach to understanding the sociocultural complexities and dynamism of vaccine attitudes at shelters.

Background

People experiencing homelessness (PEH) who utilize shelter services, as well as shelter staff, are at increased risk for coronavirus disease 2019 (COVID-19).[21,36,73] Achieving high COVID-19 vaccination coverage in shelters is critical to prevent morbidity, mortality, and outbreaks, but vaccination coverage remains lower among PEH than the general population.[21,74] Early studies have shown disparities in COVID-19 vaccination intent and uptake among PEH in the United States (U.S.).[21,75,76] Understanding reasons behind COVID-19 vaccine attitudes and factors associated with change in vaccination intent among PEH is essential to inform strategy to increase vaccine uptake now that vaccines are widely available.

A previous study conducted in King County, Washington found no trends towards increased vaccine acceptance among shelter residents or staff before the broadening of COVID-19 vaccine eligibility,[21] highlighting potential for challenges in initial COVID-19 vaccine implementation. In February 2021, approximately 45% of Seattle shelter residents and staff were undecided or not planning to receive a COVID-19 vaccine, of whom one-third did not provide a primary reason for their deliberation or reluctance. Strong disparities in COVID-19 vaccination intent associated with education and race were also observed, illustrating a need to better understand reasons for low COVID-19 vaccine acceptance and factors that associated with change in vaccination intent over time.

Various factors may influence change in vaccine attitudes and behavior over time, including risk perceptions, ideologic and demographic characteristics. Higher socioeconomic status, education, and age have been associated with higher vaccine uptake.[77–79] Political ideology has also been shown to be a determinant of vaccine-related attitudes and behaviors.[80,81] While research suggests that increased salience of a disease threat may improve attitudes toward vaccines,[82–84] preliminary data on the association between COVID-19 risk perceptions and vaccine attitudes prior to vaccine rollout show mixed findings about the direction of association.[81,85]

Here, we aimed to understand how many adult shelter residents and staff had a change in their vaccine perception, the reasons for a change in vaccine perception, and factors associated with change in intent to receive COVID-19 vaccination over time during March 2020 - August 2021 in Seattle King County. This study aims to fill critical gaps in understanding of COVID-19 vaccine attitudes among PEH to optimize vaccine implementation and coverage.

Methods

Study design and population

Our study used a single cross-sectional design to retrospectively identify factors associated with change in COVID-19 vaccination intent among shelter residents and staff during March 2020 - August 2021, after vaccines were widely available. All shelter residents and staff aged ≥18 years whose primary residence or place of employment was at one of six homeless shelters in the Seattle metropolitan area were eligible to

participate. We recruited residents and staff who were present at each shelter on a single day during July 12 - August 2, 2021 to participate and recall attitudes at various seasonal timepoints. Sites included mixed-age adult, family, and young adult shelters which were strategically selected to be sociodemographically representative of King County's sheltered PEH.[23] Survey data was collected electronically in Research Electronic Data Capture (REDCap) on tablets. Most participants completed surveys independently; however, all were offered assistance in reading the questions by a study staff member. If the participant's primary language was not English, real-time translation was provided (in-person: Spanish, Amharic, or Tigrinya; telephone translation service: all other languages). Each participant was offered a gift card to compensate for their time and effort. This study was approved by the Human Subjects Division of the University of Washington Institutional Review Board (STUDY00007800).

Measures

The primary outcome of this study was change in COVID-19 vaccination intent over time. We asked all participants the question ‘‘Overall, how have your feelings about getting a COVID-19 vaccine changed since beginning of the pandemic (Spring 2020)?", with responses categorized as more positive (‘‘I feel increasingly positive about receiving a vaccine"), more negative (‘‘I feel increasingly negative about receiving a vaccine"), change back and forth (‘‘My feelings about receiving a vaccine changed back and forth"), or no change (‘‘My feelings about receiving a vaccine have not changed"). Among participants who felt more positive or more negative about COVID-19 vaccination over time, we evaluated motivators for feeling increasingly positive or

reasons for deliberation or reluctance. We also asked participants about vaccines in general, including their thoughts on effectiveness, safety, access, and seasonal influenza vaccine receipt. Topics specific to COVID-19 included risk perceptions, experiences during the pandemic and how it impacted life, and information and educational events received at each participant's respective shelter (Appendix Materials).

To further understand changes over the pandemic, we asked participants to reflect on and self-report their perceived risk of COVID-19 and intent to receive a COVID-19 vaccine across four different seasonal time points since the beginning of the pandemic— Spring 2020 (March-May), Winter 2020 – 2021 (November-February), Spring 2021 (March-May), Summer 2021 (June-August). We used a Likert scale (1: strongly disagree to 5: strongly agree) to assess personal risk perception (''I was worried about getting COVID-19") and community risk perception (''I was worried about people in my community getting COVID-19 (e.g., friends, family, people around me)"). For COVID-19 vaccination intent, we categorized responses included vaccine accepting (''yes" or ''already vaccinated"); vaccine deliberative (''undecided"); vaccine reluctant (''no"); or prefer not to say (''Prefer not to say").[21] For each experience the participant identified (e.g., testing positive for COVID-19, being hospitalized for COVID-19, lost job or financial situation changing for the worse), we asked about the time period(s) when the experience occurred across five seasonal time points— Spring 2020 (March-May), Summer-Fall 2020 (June-October), Winter 2020 – 2021 (November-February), Spring 2021 (March-May), Summer 2021 (June-August).

Survey data also included self-reported general demographics including participant date of birth, gender, race, ethnicity (Hispanic or Latinx vs non-Hispanic or Latinx), income, marital status, number of children in household, level of highest education (a proxy for health literacy),[86] health insurance status, employment status, status as shelter staff versus resident, and experience with homelessness. Additionally, residents reported duration of homelessness; we defined chronic homelessness as duration ≥1 year.

Statistical analysis

To identify factors associated with change in COVID-19 vaccine intent becoming more positive overall compared to other attitudes (more negative, change back and forth, no change) between March 2020 - August 2021, we utilized a Poisson model to calculate Risk Ratios (RRs) with robust standard errors. This model adjusted for shelter site as a covariate to account for confounding by shelter location. We determined other variables to adjust for *a priori*, including age group, race, ethnicity, gender, employment, and participant type (resident vs staff). In addition to the model examining the relationship between becoming more positive vs all other attitudes, we conducted a secondary model excluding those who remained positive with no change in vaccine intent over time. All analyses were performed using R Statistical Software Version 4.0.3.

Results

Participant characteristics

During July 12 - August 2, 2021, 97 residents and 20 staff participated in surveys across six shelters in Seattle King County, Washington (Table 2.A.1a, 2.A.1b). Nine to 36 surveys were completed at each site with 46.2% of participants (n = 54) from two adult mixed-gender shelters, 26.5% (n = 31) from two family shelters, 19.7% (n = 23) from one older adult male shelter, and 7.7% (n = 9) from one young adult shelter. The median age of residents and staff was 46 years (range: 18 - 73 years) and 33 years (range: 21 – 81 years), respectively. Approximately 54.7% of participants (n = 64) identified as cisgender men, 26.5% (n = 31) as cisgender women, 6.8% (n = 8) as gender non-binary, and 1.7% (n = 2) as transgender men. Most participants identified as White (32.5%, n = 38) or Black/African American (30.8%, n = 36). About 13.7% of participants (n = 16) identified as Hispanic or Latinx.

Among residents and staff, 83.5% (n = 81) and 95.0% (n = 19) indicated that they had a high school education or higher, respectively. The majority of residents (62.9%, n = 61) were unemployed, however 10.3% (n = 10) indicated part-time work and 6.2% (n = 6) indicated full-time work. Among the 20 staff, 16 worked full-time and four worked part-time. While 45.0% of staff (n = 9) had employer sponsored health insurance, the majority of residents (63.9%, n = 62) were insured by Medicare, Medicaid (i.e., Washington Apple Health) or used coupons. Participants indicated usually receiving healthcare at a hospital (residents: 43.3%, n = 42; staff: 20.0%, n = 4), community clinic (residents: 33.0%, n = 32; staff: 15.0%, n = 3), and Doctor’s or Nurse Practitioner’s office (residents: 32.0%, n = 31; staff: 85.0%, n = 17). Most residents (55.7%, n = 54) reported chronic homelessness with a duration of more than one year. Among staff,

35.0% (n = 7) mentioned previously experiencing homelessness of which one mentioned current homelessness.

Vaccine perceptions and COVID-19 vaccination intent over time

Most participants agreed or strongly agreed that vaccines in general are effective (residents: 76.3%, n = 74; staff: 80.0%, n = 16), safe (residents: 66.0%, n = 64; staff: 70.0%, n = 14), and accessible (residents: 71.1%, n = 69; staff: 80.0%, n = 16). Thirty-four percent of residents (n = 33) and 50.0% of staff (n = 10) reported receiving the seasonal influenza vaccine every year. Seventy-three percent (n = 71) of residents and 70.0% (n = 14) of staff indicated that they had already received at least one dose of a COVID-19 vaccine.

When recalling vaccine attitudes in Spring 2020, 45.3% (n = 53) of all participants described that they were vaccine accepting, 35.0% (n = 41) were reluctant, and 17.1% (n = 20) were deliberative (Figure 2.A.1). By August 2021, 74.4% (n = 87) were vaccine accepting, 17.9% (n = 21) were reluctant, and 6.8% (n = 8) were deliberative at that time. Many participants (43.6%, n = 51) indicated feeling increasingly accepting about receiving a COVID-19 vaccine since March 2020, while 13.7% (n = 16) changed back and forth, 10.3% (n = 12) became more hesitant, and 32.5% (n = 38) had no change in intent.

COVID-19 risk perceptions

We found a decrease in risk perception of COVID-19 during March 2020 - August 2021. We observed a 35.0% decrease in the proportion of participants that were worried about getting COVID-19 (residents: 52.6% to 16.5%; staff: 65.0% to 35.0%) and 16.2% decrease in the proportion of participants that were worried about people in their community getting COVID-19 (residents: 68.0% to 52.6%; staff 80.0% to 60.0%) (Figure 2.A.2). Both those who received at least one dose of COVID-19 vaccine (n = 85) and those unvaccinated (n = 27) at the time of the data collection had a decrease in personal risk perception of COVID-19 during March 2020 - August 2021, with a 40.0% decrease (60.0% to 20.0%) and 25.9% decrease (44.4% to 18.5%), respectively.

Reasons for vaccine deliberation or reluctance

Of those who indicated feeling more positive about receiving a COVID-19 vaccine over time (n = 51), the most commonly cited reasons among both residents and staff were deciding the vaccine was safe (58.8%, n = 30) and effective at preventing COVID-19 (52.9%, n = 27) (Figure 2.A.3a). Other reasons included deciding that there was enough research (27.5%, n = 14), receiving encouragement by family/friends (23.5%, n = 12), receiving encouragement by a healthcare provider (19.6%, n = 10), no longer being concerned about short-term side effects (19.6%, n = 10), and receiving encouragement by a respected community leader (11.8%, n = 6).

Of those who indicated feeling more negatively about receiving a COVID-19 vaccine over time (n = 12), the most common reasons were not trusting government or authorities (58.3%, n = 7), worry about side effects (50.0%, n = 6), and waiting to see

how the vaccine affects others (50.0%, n = 6) (Figure 2.A.3b). Additional reasons included not thinking they need the vaccine (33.3%, n = 4) and thinking COVID-19 is not dangerous (25.0%, n = 3).

COVID-19 experiences and Information/education events

During March 2020 - August 2021, 43.6% (n = 51) and 31.6% (n = 37) of participants indicated that their mental or physical health worsened, respectively (Figure 2.A.4). While self-reported worsening mental health trended downwards overall since Spring 2020, there was a slight rise in Winter 2020-2021 (14.5%, n = 17) and again in Summer 2021 (9.4%, n = 11). While 50.6% of individuals vaccinated with at least one dose of a COVID-19 vaccine (n = 43) indicated that their mental health worsened at some point during the pandemic, this was only the case for 22.2% of those unvaccinated (n = 6). Three residents self-reported hospitalization due to COVID-19, and 15 participants (12 residents, 3 staff) indicated testing positive for COVID-19. Approximately 32.5% (n = 38) of participants knew someone with a bad outcome or who had died due to COVID-19, of whom 73.7% (n = 28) were vaccine accepting, 18.4% (n = 7) reluctant, and 7.9% (n = 3) deliberative. In terms of change of COVID-19 vaccination intent over time among these 38 participants, 36.8% (n = 14) felt increasingly positive, 13.2% (n = 5) felt increasingly negative, 15.8% (n = 6) changed back and forth, and 34.2% (n = 13) had no change. Forty-three participants (36.8%) lost their job or had their financial situation change for the worse, while 41 (35.0%) began experiencing homelessness.

During March 2020 - August 2021, 48.7% (n = 57) of participants indicated that they had received COVID-19 vaccine information/materials or attended a COVID-19 vaccine education event at the shelter (Figure 2.A.4). Among these 57 participants, 75.4% (n = 43) were vaccine accepting, 14.0% (n = 8) reluctant, and 10.5% (n = 6) deliberative by August 2021 with 47.4% (n = 27) feeling increasingly positive, 8.8% (n = 5) feeling increasingly negative, 15.8% (n = 9) changing back and forth, and 28.1% (n = 16) with no change in intent over time. The majority (n = 34) mentioned receiving this information or attending educational events in Spring 2021. Among all participants, 29.9% (n = 35) indicated receiving written informational materials, followed by going to a walk-up information booth (12.8%, n = 15), question and answer session (8.5%, n = 10), and/or watching an educational video (2.6%, n = 3) about COVID-19.

Factors associated with change in COVID-19 vaccination intent over time

In the primary model examining the relationship between becoming more positive about receiving a COVID-19 vaccine vs all other attitudes (n = 116), we found a 57.2% increase in vaccine acceptability (RR 1.57; 95% CI: 1.01, 2.45) among those who reported worsening mental health since the start of the pandemic (Table 2.A.2). In the secondary model excluding those who remained positive with no change in vaccine intent over time (n = 91), we found a 57.9% increase in vaccine acceptability (RR 1.58; 95% CI: 1.06, 2.35) among those who reported worsening mental health since the start of the pandemic.

Discussion

This study assessed change in intent to receive a COVID-19 vaccination, as well as reasons for change and factors associated with change, among adult shelter residents and staff in Seattle King County over time. Between the beginning of the pandemic and August 2021, intent to be vaccinated against COVID-19 increased and was similar among residents and staff. Overall, 74% of residents and 75% of staff were vaccine accepting, compared with 91% of adults in the Seattle metropolitan area as of August 2, 2021.[87] This represents a 19% increase in COVID-19 vaccine acceptance among sheltered PEH in Seattle King County since February 2021. The majority of our study participants (68%) had some change in intent over time, demonstrating potential points of intervention and opportunity to communicate information that may be useful for decision making.

Our study identifies reasons for change in residents and staff intent to be vaccinated against COVID-19. The two most common reasons cited for feeling more positive about receiving a COVID-19 vaccine over time included deciding the vaccine was safe and that the vaccine was effective at preventing COVID-19. While risk perception of COVID-19 decreased over time, the proportion of respondents who were deliberative or reluctant about COVID-19 vaccine also decreased. This is similar to trends seen in vaccine hesitancy across the U.S., with a 24% decrease in vaccine hesitancy in both King County and our population during January 1 to August 5, 2021.[88] Interviews conducted among PEH in San Francisco found that people sought more information about vaccine efficacy and safety.[89] Other studies among veterans experiencing

homelessness highlighted the importance of ensuring that information is delivered through trusted sources.[90] Thus, efforts to increase vaccine uptake among PEH should continue to include easy to understand data about efficacy and safety and prioritize delivery of clear, relevant, tailored information through trusted mechanisms.

The most common reasons for feeling more negative about receiving a COVID-19 vaccine over time were not trusting government or authorities, worry about side effects, and waiting to see how the vaccine affects others. Mistrust of government institutions has been observed to contribute to vaccine acceptability in both the general population and PEH elsewhere, specifically related to experiences of racism.[89,91] Thus further exploration of how experiences with racism may impact vaccine mistrust may be key to tailoring future communications. Lack of the U.S. Food and Drug Administration (FDA)'s full approval of COVID-19 vaccines at the time of this study may have also contributed to mistrust and vaccine deliberation or reluctance.[92] As we previously observed a change in the reasons for vaccine deliberation or reluctance corresponding to the Emergency Use Authorization in shelter settings,[21] FDA approval of COVID-19 vaccines may impact trust and reasons for vaccination moving forward.[92] A study among sheltered PEH in Detroit, Michigan in February 2021 also found primary reasons for COVID-19 vaccine hesitancy to be concern about side effects and fear of unknown long-term impacts of the vaccine.[75] Utilizing qualitative methods to learn more about reasons why and factors associated with change will be key to designing public health programming around vaccination.

In the models evaluating factors associated with change in intent, the factor significantly associated with a more positive change in COVID-19 vaccination intent was worsening mental health since the start of the pandemic. Mental health decline among participants is likely situationally induced and associated with pandemic fatigue (i.e., repeated stress due to isolation, quarantine, etc.) and loss of autonomy.[90,93] Additionally, receiving the first dose of a COVID-19 vaccine has been shown to result in mental health improvements.[94] Therefore, vaccination against COVID-19 may have been a protective behavior due to increased vulnerability and isolation in shelters and viewed as a step in the right direction to mitigate mental health symptoms. Alternatively, mental health worsening and increasing vaccine acceptance may both be functions of time and not causally related to each other (i.e., time may be a confounder). Between the beginning of the pandemic and August 2021, over one-third of participants indicated that their mental health worsened; However, we observed a greater proportion of participants with worsening mental health at the start of the pandemic as compared to August 2021. This is similar to initial trends seen in a study among PEH between 16 and 24 years in the United Kingdom that found improved self-reported mental well-being between February and April 2020.[90]

Receiving COVID-19 vaccine information/materials or attending a COVID-19 vaccine education event at the shelter was not associated with more positive change in vaccine perception. Only approximately half of participants had received COVID-19 vaccine information or attended a COVID-19 vaccine education event at the shelter, leaving room for improvement towards creating a supportive environment to reach and

communicate information about COVID-19 vaccines in shelters. Shelter management and public health entities may be best suited to provide COVID-19 information and lead educational events depending on residents' level of trust of these sources.[95] Considering that most participants in our study cited commonly receiving healthcare at a hospital or in a clinic setting, these may be trusted locations where COVID-19 vaccine information can be disseminated to PEH. However, while COVID-19 vaccine recommendation from a provider can be a strong motivator to improve confidence and coverage,[96] deep and often well-earned mistrust of established institutions (e.g., clinics or hospitals) may persist among some PEH;[97] thus, multiple channels of engagement may be important to provide the greatest cumulative effect to increase COVID-19 vaccine coverage. Our findings about reasons and factors associated with vaccination can be used to tailor programing to increase accessibility of information and vaccine uptake.

These findings are subject to several limitations. Information bias may be present due to self-report, such as social desirability bias. For example, there may be a tendency to respond favorably as vaccinated or planning to be vaccinated due to fear of losing access to shelter services or employment. To mitigate this limitation and reduce potential misclassification, we provided options of ‘‘Don't know" and ‘‘Prefer not to say,‘‘ as well as verbal and written assurances that data would remain anonymous to shelter administration. Furthermore, recall bias is likely present given the need for participants to remember perceptions and vaccination intent at previous timepoints. However, we used seasons to help with recall at various timepoints. As there was limited data

available about the content and how actively residents and staff participated in COVID-19 educational events, understanding the relationship between these and change vaccination intent is challenging. Results may also be subject to selection bias as participation was voluntary and respondents may not be representative of the overall population of sheltered PEH. Given high levels of distrust of health care providers and documented low rates of health care use in homeless populations[97–99] participants in our study may not reflect those unwilling to participate and interact with study staff. Thus, vaccine intent among participants may not reflect the intention of those unwilling to participate. Finally, these findings may not be representative of all King County shelters or generalizable to PEH in other locations. However, by including a range of different types of shelters, we attempted to broaden applicability. This study represents the first part of a sequential, two-phased collection and analysis of quantitative and qualitative data. Forthcoming qualitative findings aim to provide further insight on vaccine attitudes, reasons for vaccination, and recommendations to improve COVID-19 vaccine uptake among residents and staff.

Conclusion

We found an overall increase in COVID-19 vaccine acceptability among residents and staff between the beginning of the pandemic and August 2021. Findings highlight opportunities to improve communication with residents and staff about COVID-19 vaccination. While worsening mental health since the start of the pandemic was associated with increased vaccine acceptability over time, we did not identify any modifiable factors that may influence more positive change in COVID-19 vaccination

intent. Our findings support a need for continued dialogue and a person-centered approach to understanding the sociocultural complexities and dynamism of vaccine attitudes at shelters. This, along with learnings from qualitative interviews in progress, are critical to successful implementation of programming that are accessible, trusted, and can optimize COVID-19 vaccine coverage.

Tables and Figures

Table 2.A.1.a. Unique survey responses among shelter residents, by change in COVID-19 vaccine intent between March 2020 - August 2021 (N = 97)

	Change in intent to be vaccinated against COVID-19 between March 2020 – August 2021, n(%)†					
	Change, more positive (n=44, 45.4%)	**Change, more negative (n=10, 10.3%)**	**Change, back and forth (n=13, 13.4%)**	**No change, accepting (n=19, 19.6%)**	**No change, reluctant/deliberative (n=11, 11.3%)**	**Total (n=97)**
Age (years)						
Median [Min, Max]	47.0 [19, 73]	40.0 [22, 72]	36.0 [18, 60]	50.0 [19, 69]	47.0 [25, 71]	46.0 [18, 73]
Age group (years)						
18-49	24 (42.9%)	6 (10.7%)	11 (19.6%)	9 (16.1%)	6 (10.7%)	56 (57.7%)
50-64	17 (51.5%)	2 (6.1%)	2 (6.1%)	8 (24.2%)	4 (12.1%)	33 (34.0%)
65+	3 (37.5%)	2 (25.0%)	0 (0.0%)	2 (25.0%)	1 (12.5%)	8 (8.3%)
Gender						
Cisgender man	28 (50.9%)	5 (9.1%)	7 (12.7%)	12 (21.8%)	3 (5.5%)	55 (56.7%)
Cisgender woman	10 (43.5%)	2 (8.7%)	3 (13.0%)	3 (13.0%)	5 (21.7%)	23 (23.7%)
Transgender man	0 (0.0%)	1 (50.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)	2 (2.1%)
Transgender woman	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Gender non-binary	1 (20.0%)	1 (20.0%)	1 (20.0%)	2 (40.0%)	0 (0.0%)	5 (5.2%)
Other	2 (40.0%)	1 (20.0%)	1 (20.0%)	0 (0.0%)	1 (20.0%)	5 (5.2%)
Prefer not to say	3 (42.9%)	0 (0.0%)	1 (14.3%)	1 (14.3%)	2 (28.6%)	7 (7.2%)
Hispanic						
Yes	7 (53.8%)	0 (0.0%)	1 (7.7%)	3 (23.1%)	2 (15.4%)	13 (13.4%)
No	35 (44.3%)	10 (12.7%)	11 (13.9%)	15 (19.0%)	8 (10.1%)	79 (81.4%)
Prefer not to say	2 (40.0%)	0 (0.0%)	1 (20.0%)	1 (20.0%)	1 (20.0%)	5 (5.2%)
Race						
White	13 (39.4%)	3 (9.1%)	5 (15.2%)	10 (30.3%)	2 (6.1%)	33 (34.0%)
Black or African American	12 (44.4%)	3 (11.1%)	3 (11.1%)	5 (18.5%)	4 (14.8%)	27 (27.8%)
Asian	3 (60.0%)	1 (20.0%)	0 (0.0%)	1 (20.0%)	0 (0.0%)	5 (5.2%)
American Indian or Alaska Native	3 (75.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (4.1%)
Native Hawaiian or Pacific Islander	1 (50.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	2 (2.1%)
Multiracial	4 (30.8%)	2 (15.4%)	3 (23.1%)	1 (7.7%)	3 (23.1%)	13 (13.4%)
Prefer not to say	8 (61.5%)	0 (0.0%)	1 (7.7%)	2 (15.4%)	2 (15.4%)	13 (13.4%)
Highest education						

	Change in intent to be vaccinated against COVID-19 between March 2020 – August 2021, n(%)†					
	Change, more positive (n=44, 45.4%)	**Change, more negative (n=10, 10.3%)**	**Change, back and forth (n=13, 13.4%)**	**No change, accepting (n=19, 19.6%)**	**No change, reluctant/deliberative (n=11, 11.3%)**	**Total (n=97)**
Less than high school graduate	6 (42.9%)	3 (21.4%)	3 (21.4%)	1 (7.1%)	1 (7.1%)	14 (14.4%)
Graduated high school/obtained GED	16 (41.0%)	3 (7.7%)	7 (17.9%)	10 (25.6%)	3 (7.7%)	39 (40.2%)
Some college	18 (56.2%)	2 (6.2%)	3 (9.4%)	5 (15.6%)	4 (12.5%)	32 (33.0%)
Bachelor's degree or higher	4 (40.0%)	2 (20.0%)	0 (0.0%)	2 (20.0%)	2 (20.0%)	10 (10.3%)
Prefer not to say	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (50.0%)	1 (50.0%)	2 (2.1%)
Employment						
Full time	3 (50.0%)	0 (0.0%)	1 (16.7%)	1 (16.7%)	1 (16.7%)	6 (6.2%)
Part time	5 (50.0%)	0 (0.0%)	3 (30.0%)	1 (10.0%)	1 (10.0%)	10 (10.3%)
Contract/temp work, furloughed	3 (60.0%)	1 (20.0%)	0 (0.0%)	1 (20.0%)	0 (0.0%)	5 (5.1%)
Unemployed	28 (45.9%)	7 (11.5%)	5 (8.2%)	15 (24.6%)	6 (9.8%)	61 (62.9%)
Other	2 (40.0%)	0 (0.0%)	2 (40.0%)	0 (0.0%)	1 (20.0%)	5 (5.2%)
Prefer not to say	3 (30.0%)	2 (20.0%)	2 (20.0%)	1 (10.0%)	2 (20.0%)	10 (10.3%)
Health insurance						
Employer-sponsored	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (2.1%)
Medicaid/care, WA Apple Health, coupons	27 (43.5%)	5 (8.1%)	10 (16.1%)	12 (19.4%)	8 (12.9%)	62 (63.9%)
Multiple Insurance types	6 (60.0%)	1 (10.0%)	1 (10.0%)	2 (20.0%)	0 (0.0%)	10 (10.3%)
Other	1 (14.3%)	2 (28.6%)	1 (14.3%)	3 (42.9%)	0 (0.0%)	7 (7.2%)
None	4 (57.1%)	0 (0.0%)	0 (0.0%)	2 (28.6%)	1 (14.3%)	7 (7.2%)
Prefer not to say	5 (71.4%)	1 (14.3%)	0 (0.0%)	0 (0.0%)	1 (14.3%)	7 (7.2%)
Purchased outside of employer	0 (0.0%)	0 (0.0%)	1 (50.0%)	0 (0.0%)	1 (50.0%)	2 (2.1%)
Duration of homelessness						
<= 6 months	9 (39.1%)	2 (8.7%)	5 (21.7%)	3 (13.0%)	4 (17.4%)	23 (23.7%)
7-12 months	7 (41.2%)	2 (11.8%)	2 (11.8%)	4 (23.5%)	2 (11.8%)	17 (17.5%)
13-24 months	7 (50.0%)	2 (14.3%)	1 (7.1%)	3 (21.4%)	1 (7.1%)	14 (14.4%)
>24 months	19 (47.5%)	4 (10.0%)	4 (10.0%)	9 (22.5%)	4 (10.0%)	40 (41.2%)
Don't know	2 (66.7%)	0 (0.0%)	1 (33.3%)	0 (0.0%)	0 (0.0%)	3 (3.09%)
Received COVID-19 vaccine (1+ dose)						
Yes	40 (56.3%)	4 (5.6%)	7 (9.9%)	19 (26.8%)	1 (1.4%)	71 (73.2%)
No	3 (14.3%)	5 (23.8%)	4 (19.0%)	0 (0.0%)	9 (42.9%)	21 (21.6%)
Don't know	0 (0.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)	0 (0.0%)	2 (2.1%)
Prefer not to say	1 (33.3%)	0 (0.0%)	1 (33.3%)	0 (0.0%)	1 (33.3%)	3 (3.1%)

	Change in intent to be vaccinated against COVID-19 between March 2020 – August 2021, n(%)†					
	Change, more positive (n=44, 45.4%)	**Change, more negative (n=10, 10.3%)**	**Change, back and forth (n=13, 13.4%)**	**No change, accepting (n=19, 19.6%)**	**No change, reluctant/deliberative (n=11, 11.3%)**	**Total (n=97)**
Current vaccination intent						
Accepting	42 (58.3%)	4 (5.6%)	7 (9.7%)	19 (26.4%)	0 (0.0%)	72 (74.2%)
Deliberative	0 (0.0%)	1 (14.3%)	5 (71.4%)	0 (0.0%)	1 (14.3%)	7 (7.2%)
Reluctant	2 (11.8%)	5 (29.4%)	0 (0.0%)	0 (0.0%)	10 (58.8%)	17 (17.5%)
Prefer not to say	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	1 (1.0%)
Received COVID-19 information/attended COVID-19 education event						
Yes	23 (45.1%)	4 (7.8%)	9 (17.6%)	9 (17.6%)	6 (11.8%)	51 (52.6%)
No	18 (46.2%)	6 (15.4%)	3 (7.7%)	8 (20.5%)	4 (10.3%)	39 (40.2%)
Don't know	2 (50.0%)	0 (0.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)	4 (4.1%)
Prefer not to say	1 (33.3%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	1 (33.3%)	3 (3.1%)

† All columns apart from “Total” have calculated row percentages; “Total” column percentages calculated exclude missing response

Table 2.A.1.b. Unique survey responses among shelter staff, by change in COVID-19 vaccine intent between March 2020 - August 2021 (N = 20)

	Change in intent to be vaccinated against COVID-19 between March 2020 – August 2021, n(%)†					
	Change, more positive (n=7, 35.0%)	**Change, more negative (n=2, 10.0%)**	**Change, back and forth (n=3, 15.0%)**	**No change, accepting (n=6, 30.0%)**	**No change, reluctant/deliberative (n=2, 10.0%)**	**Total (n=20)**
Age (years)						
Median [Min, Max]	48.0 [22, 81]	39.0 [24, 54]	33.0 [30, 34]	25.5 [21, 48]	37.0 [21, 53]	32.5 [21, 81]
Age group (years)						
18-49	4 (26.7%)	1 (6.7%)	3 (20.0%)	6 (40.0%)	1 (6.7%)	15 (75.0%)
50-64	1 (33.3%)	1 (33.3%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	3 (15.0%)
65+	2 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (10.0%)
Gender						
Cisgender man	2 (22.2%)	2 (22.2%)	1 (11.1%)	3 (33.3%)	1 (11.1%)	9 (45.0%)
Cisgender woman	4 (50.0%)	0 (0.0%)	2 (25.0%)	2 (25.0%)	0 (0.0%)	8 (40.0%)
Transgender man	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Transgender woman	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Gender non-binary	1 (33.3%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	1 (33.3%)	3 (15.0%)
Other	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Prefer not to say	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Hispanic						
Yes	1 (33.3%)	1 (33.3%)	0 (0.0%)	0 (0.0%)	1 (33.3%)	3 (15.0%)
No	6 (35.3%)	1 (5.9%)	3 (17.6%)	6 (35.3%)	1 (5.9%)	17 (85.0%)
Prefer not to say	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Race						
White	3 (60.0%)	0 (0.0%)	0 (0.0%)	2 (40.0%)	0 (0.0%)	5 (25.0%)
Black or African American	4 (44.4%)	1 (11.1%)	1 (11.1%)	1 (11.1%)	2 (22.2%)	9 (45.0%)
Asian	0 (0.0%)	1 (25.0%)	1 (25.0%)	2 (50.0%)	0 (0.0%)	4 (20.0%)
American Indian or Alaska Native	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Native Hawaiian or Pacific Islander	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Multiracial	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Prefer not to say	0 (0.0%)	0 (0.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)	2 (10.0%)
Highest education						
Less than high school graduate	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	1 (5.0%)
Graduated high school/obtained GED	1 (33.3%)	0 (0.0%)	1 (33.3%)	0 (0.0%)	1 (33.3%)	3 (15.0%)
Some college	1 (16.7%)	0 (0.0%)	1 (16.7%)	3 (50.0%)	1 (16.7%)	6 (30.0%)

	Change in intent to be vaccinated against COVID-19 between March 2020 – August 2021, n(%)†					
	Change, more positive (n=7, 35.0%)	**Change, more negative (n=2, 10.0%)**	**Change, back and forth (n=3, 15.0%)**	**No change, accepting (n=6, 30.0%)**	**No change, reluctant/deliberative (n=2, 10.0%)**	**Total (n=20)**
Bachelor's degree	4 (66.7%)	0 (0.0%)	0 (0.0%)	2 (33.3%)	0 (0.0%)	6 (30.0%)
Advanced degree	1 (25.0%)	2 (50.0%)	0 (0.0%)	1 (25.0%)	0 (0.0%)	4 (20.0%)
Prefer not to say	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Employment						
Full time	6 (37.5%)	2 (12.5%)	3 (18.8%)	3 (18.8%)	2 (12.5%)	16 (80.0%)
Part time	1 (25.0%)	0 (0.0%)	0 (0.0%)	3 (75.0%)	0 (0.0%)	4 (20.0%)
Health insurance						
Employer-sponsored	2 (22.2%)	2 (22.2%)	1 (11.1%)	3 (33.3%)	1 (11.1%)	9 (45.0%)
Medicaid, WA Apple Health, or coupons	1 (25.0%)	0 (0.0%)	0 (0.0%)	2 (50.0%)	1 (25.0%)	4 (20.0%)
Medicare	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (5.0%)
Multiple Insurance types	2 (50.0%)	0 (0.0%)	1 (25.0%)	1 (25.0%)	0 (0.0%)	4 (20.0%)
Other	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (5.0%)
None	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	1 (5.0%)
Ever homeless						
Yes, past	3 (50.0%)	1 (16.7%)	1 (16.7%)	0 (0.0%)	1 (16.7%)	6 (30.0%)
Yes, currently	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	1 (5.0%)
No	4 (30.8%)	1 (7.7%)	1 (7.7%)	6 (46.2%)	1 (7.7%)	13 (65.0%)
Received COVID-19 vaccine (1+ dose)						
Yes	7 (50.0%)	0 (0.0%)	1 (7.1%)	6 (42.9%)	0 (0.0%)	14 (70.0%)
No	0 (0.0%)	2 (33.3%)	2 (33.3%)	0 (0.0%)	2 (33.3%)	6 (30.0%)
Don't know	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Prefer not to say	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Current vaccination intent						
Accepting	7 (46.7%)	0 (0.0%)	2 (13.3%)	6 (40.0%)	0 (0.0%)	15 (75.0%)
Deliberative	0 (0.0%)	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)	1 (5.0%)
Reluctant	0 (0.0%)	2 (50.0%)	0 (0.0%)	0 (0.0%)	2 (50.0%)	4 (20.0%)
Prefer not to say	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Received COVID-19 information/attended COVID-19 education event						
Yes	4 (66.7%)	1 (16.7%)	0 (0.0%)	1 (16.7%)	0 (0.0%)	6 (30.0%)
No	3 (25.0%)	1 (8.3%)	2 (16.7%)	4 (33.3%)	2 (16.7%)	12 (60.0%)
Don't know	0 (0.0%)	0 (0.0%)	1 (50.0%)	1 (50.0%)	0 (0.0%)	2 (10.0%)

† All columns apart from “Total” have calculated row percentages; “Total” column percentages calculated exclude missing responses

Table 2.A.2. Factors associated with more positive overall change in COVID-19 vaccine intent, according to Poisson model between March 2020 - August 2021

	Model 1 More positive vs. all others (n=116)		Model 2 More positive vs. other change + remain negative (n=91)	
Characteristic	**aRR†**	**95% CI**	**aRR†**	**95% CI**
Received COVID-19 information/attended COVID-19 education event				
Yes	1.30	(0.79, 2.14)	1.13	(0.74, 1.72)
No	Reference		Reference	
Physical health changed for the worse				
Yes	0.88	(0.53, 1.47)	0.80	(0.47, 1.37)
No	Reference		Reference	
Mental health changed for the worse				
Yes	**1.57**	**(1.01, 2.45)**	**1.58**	**(1.06, 2.35)**
No	Reference		Reference	
Lost job or worsened financial situation				
Yes	1.53	(0.89, 2.62)	1.32	(0.77, 2.30)
No	Reference		Reference	
Started experiencing homelessness				
Yes	0.81	(0.45, 1.45)	0.57	(0.31, 1.07)
No	Reference		Reference	
Knew someone who had a bad outcome or lost anyone due to COVID-19 disease				
Yes	0.74	(0.44, 1.26)	0.84	(0.53, 1.31)
No	Reference		Reference	
Age group				
18-49 y	0.92	(0.38, 2.23)	1.04	(0.52, 2.09)
50-64 y	0.81	(0.40, 1.82)	0.90	(0.46, 1.78)
≥ 65 y	Reference		Reference	
Race				
American Indian/ Alaska Native	1.62	(0.58, 4.49)	1.10	(0.47, 2.61)
Asian	1.14	(0.42, 3.12)	1.04	(0.45, 2.41)
Black/African American	1.23	(0.79, 2.07)	1.10	(0.73, 1.66)
Multiracial	0.68	(0.28, 1.65)	0.55	(0.24, 1.28)
Native Hawaiian/ Pacific Islander	1.52	(0.24, 9.67)	1.16	(0.19, 6.98)
Prefer not to say	1.03	(0.46, 2.31)	1.01	(0.53, 1.91)
White	Reference		Reference	
Ethnicity				
Hispanic	1.12	(0.52, 2.43)	1.06	(0.56, 2.00)
Non-Hispanic	Reference		Reference	
Gender				
Cisgender women	1.05	(0.56, 1.97)	1.09	(0.63, 1.89)
Transgender or non-binary	0.47	(0.13, 1.67)	0.60	(0.21, 1.71)
Other, prefer not to say	1.03	(0.41, 2.59)	0.95	(0.41, 2.24)
Cisgender men	Reference		Reference	
Unemployed				
Yes	0.94	(0.55, 1.60)	1.01	(0.60, 1.72)
No	Reference		Reference	
Participant type				
Resident	1.03	(0.43, 2.46)	1.12	(0.54, 2.32)

Staff	Reference		Reference	
Shelter site				
Site B	1.38	(0.69, 2.76)	1.27	(0.72, 2.21)
Site C	0.94	(0.41, 2.17)	0.79	(0.37, 1.69)
Site D	0.81	(0.34, 1.90)	1.15	(0.52, 2.54)
Site E	0.55	(0.22, 1.38)	0.75	(0.31, 1.74)
Site F	0.53	(0.15, 1.88)	0.76	(0.23, 2.55)
Site A (DE)	Reference		Reference	

†aRR = adjusted risk ratio using robust standard errors

Figure 2.A.1. COVID-19 vaccination intent among shelter residents and staff, March 2020 - August 2021 (N = 117)

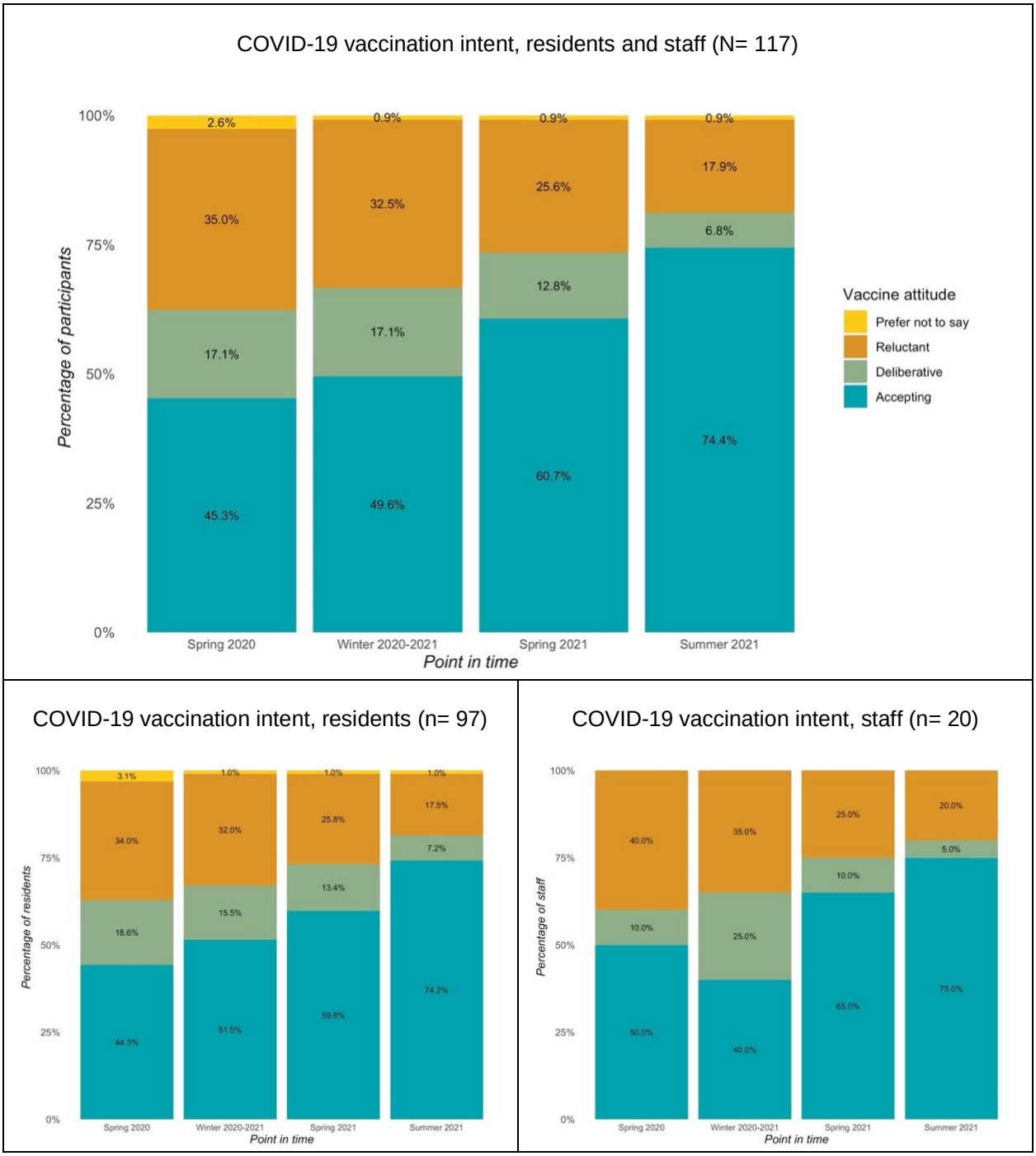
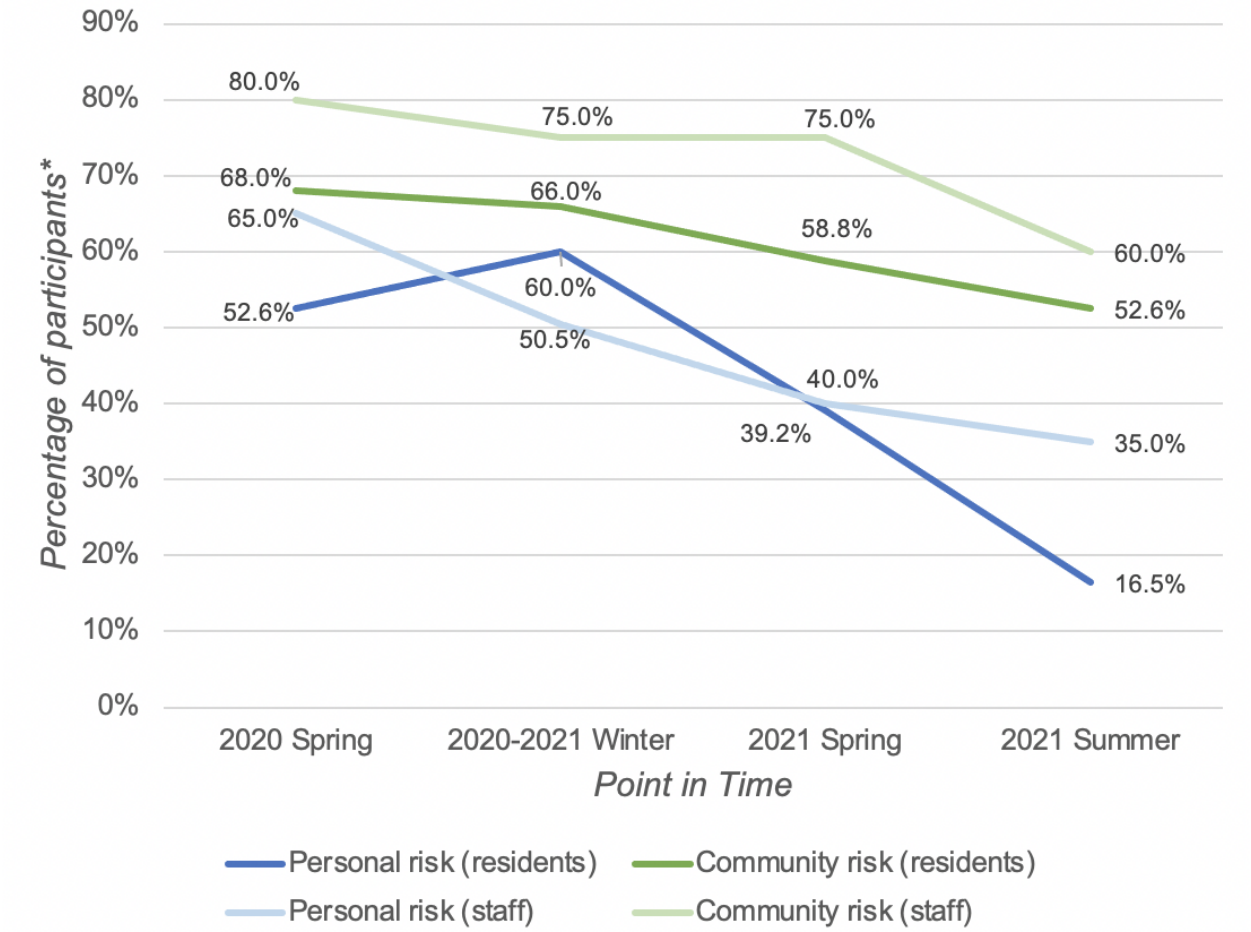
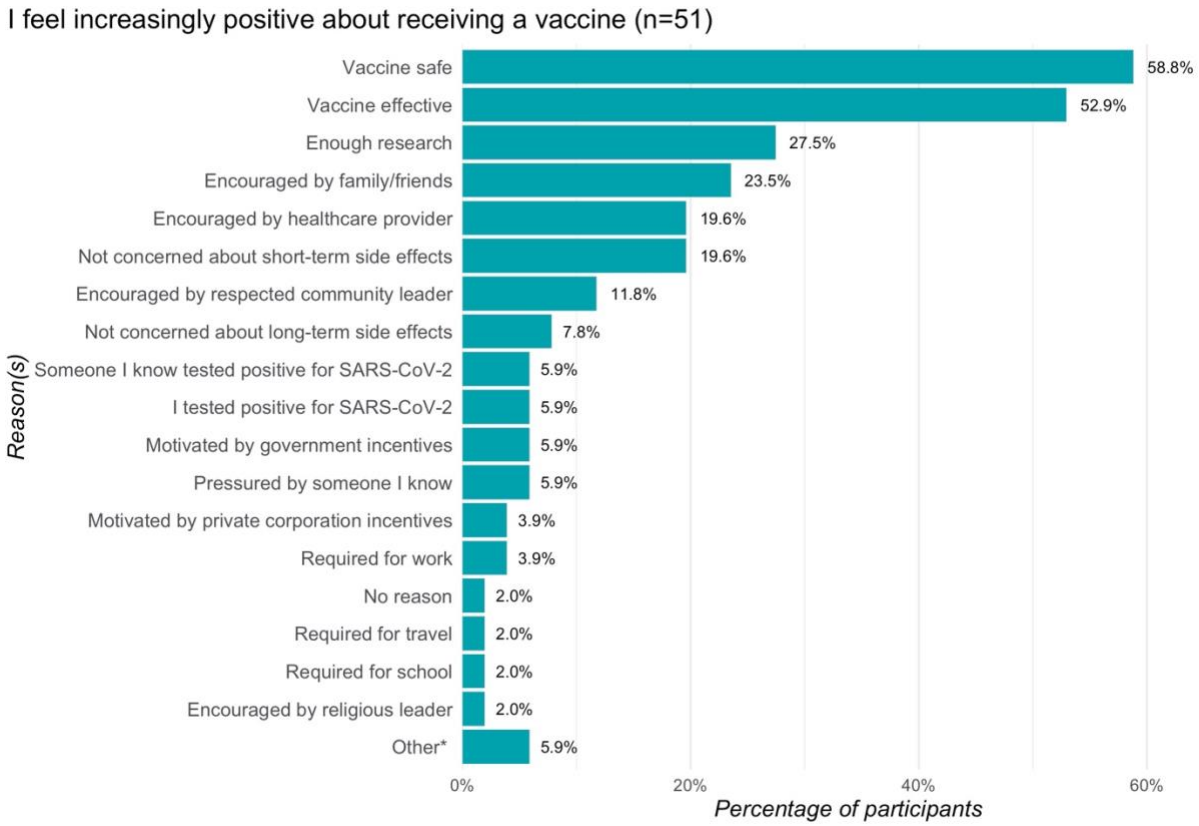


Figure 2.A.2. Perception of individual and community COVID-19 risk by shelter residents and staff, March 2020 - August 2020



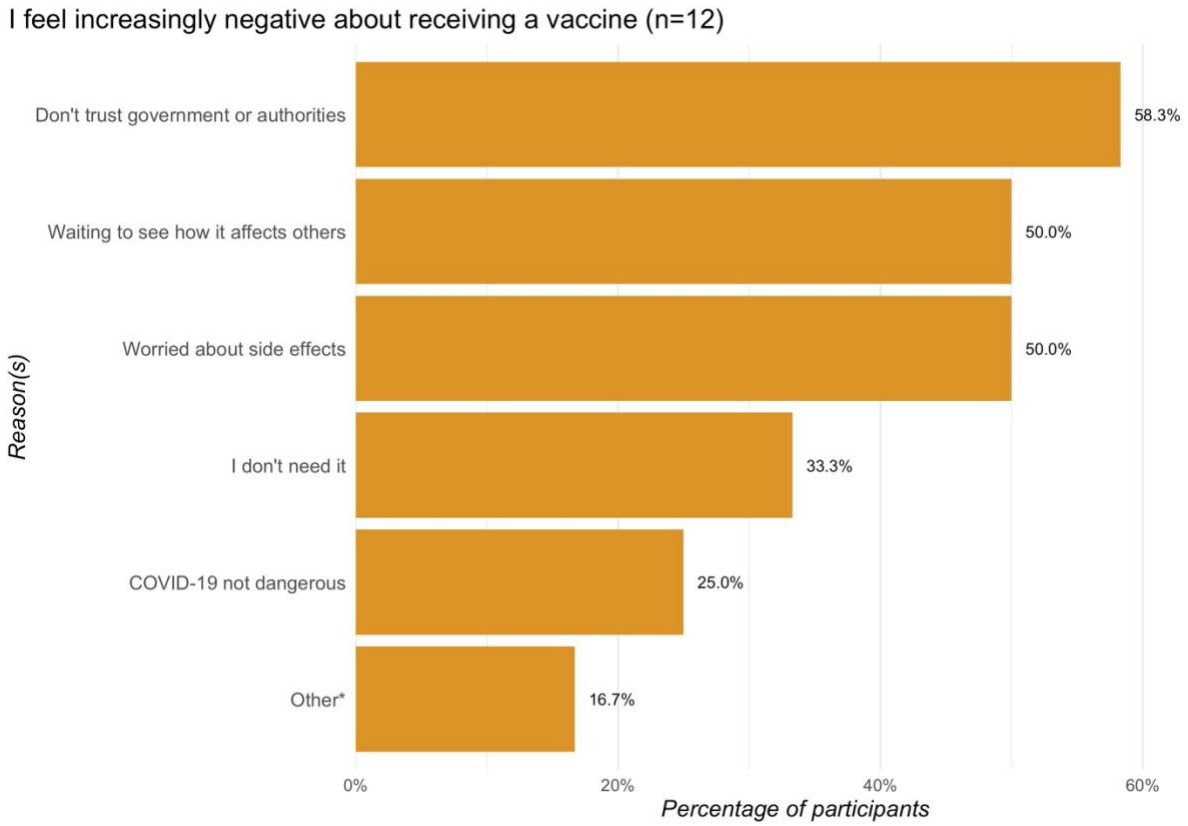
*Percentage of participants who agree or strongly agree with the statement ‘‘I was worried about getting COVID-19” (personal risk perception) and ‘‘I was worried about people in my community getting COVID-19 (e.g., friends, family, people around me)” (community risk perception).

Figure 2.A.3.a. Shelter resident and staff reasons for more positive in vaccination intent, March 2020 - August 2021



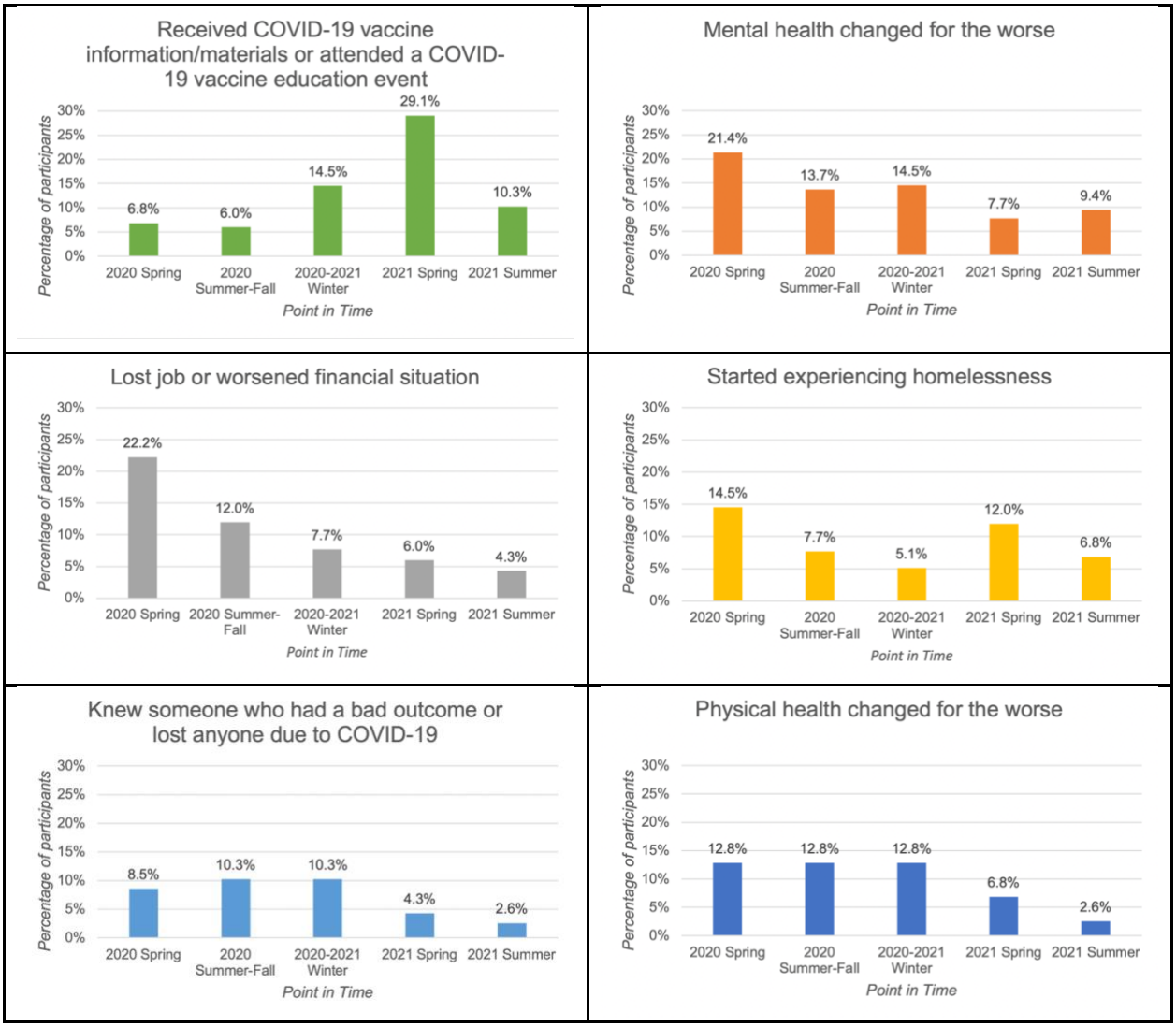
*Other includes free-text responses: ‘‘I am high risk”, ‘‘Saw how COVID-19 vaccine affected others”, ‘‘Worried about spikes in cases”.

Figure 2.A.3.b. Shelter resident and staff reasons for more negative vaccination intent, March 2020 - August 2021



*Other includes free-text responses: ‘‘God will protect us”; ‘‘I had gotten the Flu shot and it gave me severe Pneumonia”.

Figure 2.A.4. Shelter resident and staff experiences across the COVID-19 pandemic, March 2020 - August 2021 (N = 117*)



*The total unique individuals who mentioned a given experience at any point between March 2020 - August 2021 (n) are as follows: Received COVID-19 vaccine information/materials or attended a COVID-19 vaccine education event (n = 57), Mental health changed for the worse (n = 51), Lost job or financial situation changed for the worse (n = 43), Started experiencing homelessness (n = 41), Knew someone who had a bad outcome or lost anyone due to COVID-19 (n = 38), Physical health changed for the worse (n = 37).

Appendix Materials

Point-in-Time Survey

0. Date and Time: MM/DD/YYYY HH:MM [AM/PM]

1. Shelter location: _____

2. Are you a shelter staff member?
    - Yes
    - No

3. What is your preferred language for your study participation?
    - English
    - Spanish
    - Amharic
    - Tigrinya
    - Ngala
    - Marshallese
    - Other, please specify: _____

4. Enter your birthday: MM/DD/YYYY

GENERAL VACCINE ATTITUDES

We will first read you a series of statements about how you feel about vaccines in general- not just COVID-19 vaccines. This could include flu vaccines, childhood vaccines, HPV vaccines, etc. Please choose the answer that best applies to you.

5. In general, vaccines will work to fight disease (are effective).
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

6. In general, vaccines are safe.
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

7. In general, vaccines are easy to get/access.
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

8. How often do you get the seasonal flu vaccine?
    - Every year
    - Most years
    - Some years
    - Never
    - Prefer not to say

COVID-19 RISK PERCEPTIONS, VACCINE ATTITUDES, AND EXPERIENCES OVER TIME

We are now going to ask you to think back to your experiences over the COVID-19 pandemic. Select all that apply.

9. Since the start of the COVID-19 pandemic, have you...? Select all that apply.
    - Tested positive for COVID-19
    - Been hospitalized due to COVID-19 disease
    - Spent time in a COVID-19 Isolation & Quarantine unit
    - Known someone who had a bad outcome or lost anyone due to COVID-19 disease
    - Lost a job or your financial situation changed for the worse
    - Started experiencing homelessness
    - Had your mental health (e.g., feeling sad, depressed, anxious, stressed) change for the worse
    - Had your physical health change for the worse
    - None of the above
    - Prefer not to say

10. Around what time did you test positive for COVID-19? Select all that apply.
    - Spring 2020 (around the start of the pandemic; February-May)
    - Summer-Fall 2020 (June-October)
    - Winter 2020-2021 (around the holidays; November-February)
    - Spring 2021(March-May)
    - Summer 2021 (June-August)

11. Around what time were you hospitalized due to COVID-19 disease? Select all that apply.

- Spring 2020 (around the start of the pandemic; February-May)
- Summer-Fall 2020 (June-October)
- Winter 2020-2021 (around the holidays; November-February)
- Spring 2021(March-May)
- Summer 2021 (June-August)

12. Around what time were you in a COVID-19 Isolation & Quarantine unit? Select all that apply.
    - Spring 2020 (around the start of the pandemic; February-May)
    - Summer-Fall 2020 (June-October)
    - Winter 2020-2021 (around the holidays; November-February)
    - Spring 2021(March-May)
    - Summer 2021 (June-August)

13. Around what time did you someone you know had a bad outcome or died due to COVID-19 disease? Select all that apply.
    - Spring 2020 (around the start of the pandemic; February-May)
    - Summer-Fall 2020 (June-October)
    - Winter 2020-2021 (around the holidays; November-February)
    - Spring 2021(March-May)
    - Summer 2021 (June-August)

14. Around what time did you lose your job or have your financial situation change for the worse? Select all that apply.
    - Spring 2020 (around the start of the pandemic; February-May)
    - Summer-Fall 2020 (June-October)
    - Winter 2020-2021 (around the holidays; November-February)
    - Spring 2021(March-May)
    - Summer 2021 (June-August)

15. Around what time did you start experiencing homelessness? Select all that apply.
    - Spring 2020 (around the start of the pandemic; February-May)
    - Summer-Fall 2020 (June-October)
    - Winter 2020-2021 (around the holidays; November-February)
    - Spring 2021 (March-May)
    - Summer 2021 (June-August)

16. Around what time did your mental health (e.g., feeling sad, depressed, anxious, stressed) change for the worse? Select all that apply.
    - Spring 2020 (around the start of the pandemic; February-May)
    - Summer-Fall 2020 (June-October)

- Winter 2020-2021 (around the holidays; November-February)
- Spring 2021(March-May)
- Summer 2021 (June-August)

17. Around what time did your physical health change for the worse? Select all that apply.
    - Spring 2020 (around the start of the pandemic; February-May)
    - Summer-Fall 2020 (June-October)
    - Winter 2020-2021 (around the holidays; November-February)
    - Spring 2021(March-May)
    - Summer 2021 (June-August)

We are now going to ask you to think back to your feelings about COVID-19 since the start of the pandemic. We will begin with how you felt in Spring 2020 (around the start of the pandemic; February-May) and then ask again about different seasons. While these questions may feel similar, we are asking about different time points to understand how your feelings have changed over the different seasons.

18. In Spring of 2020 (around the start of the pandemic), I was worried about getting COVID-19.
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

19. In Spring of 2020 (around the start of the pandemic), I was worried about people in my community getting COVID-19 (e.g., friends, family, people around me).
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

20. In Spring of 2020 (around the start of the pandemic), did you intend to receive a COVID-19 vaccine, once it became available to you?
    - Yes, I planned to
    - I was undecided
    - No, I did not plan to
    - Prefer not to say

We will now ask how you felt around the holidays (Winter 2020-2021; November-February).

21. Around the holidays (Winter 2020-2021), I was worried about getting COVID-19.
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

22. Around the holidays (Winter 2020-2021), I was worried about people in my community getting COVID-19 (e.g., friends, family, people around me).
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

23. Around the holidays (Winter 2020-2021), did you intend to receive a COVID-19 vaccine, once it became available to you?
    - Yes, I planned to (or I was vaccinated around this time)
    - I was undecided
    - No, I did not plan to
    - Prefer not to say

We will now ask how you felt around Spring 2021 (when the vaccine became more available; March-May).

24. Around Spring 2021, I was worried about getting COVID-19.
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

25. Around Spring 2021, I was worried about people in my community getting COVID-19 (e.g., friends, family, people around me).
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

26. Around Spring 2021, did you intend to receive a COVID-19 vaccine, once it became available to you?
    - Yes, I planned to (or I was vaccinated around this time)

- I was undecided
- No, I did not plan to
- Prefer not to say

We will now ask how you feel currently (as of Summer 2021; June-August).

27. Currently, I am worried about getting COVID-19.
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

28. Currently, I am worried about people in my community getting COVID-19 (e.g., friends, family, people around me).
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

29. Currently, do you intend to receive a COVID-19 vaccine?
    - Yes, I plan to (or I was recently vaccinated
    - I am undecided
    - No, I do not plan to
    - Prefer not to say

30. Currently, I believe that COVID-19 testing works to identify COVID-19 disease (is effective).
    - Strongly disagree
    - Disagree
    - Neutral (neither agree or disagree)
    - Agree
    - Strongly agree

We will now ask about how you feel about COVID-19 vaccines overall.

31. Overall, how have your feelings about getting a COVID-19 vaccine changed since beginning of the pandemic (Spring 2020)?
    - I feel increasingly positive about receiving vaccine
    - I feel increasingly negative about receiving a vaccine
    - My feelings about receiving a vaccine changed back and forth
    - My feelings about receiving a vaccine have not changed

32. Why did you feel more positive about receiving a COVID-19 vaccine? Select all that apply.
    - I decided the vaccine was safe
    - I decided the vaccine was effective at preventing COVID-19
    - I decided I was no longer concerned about short-term side effects
    - I decided I was no longer concerned about long-term side effects
    - I decided that there was enough research
    - I was encouraged to get the vaccine by my family and/or friends
    - I was encouraged to get the vaccine by a respected community leader
    - I was encouraged to get the vaccine by a religious leader
    - I was encouraged to get the vaccine by a healthcare provider
    - I was required to get the vaccine for my job
    - I was required to get the vaccine to attend school or university as student
    - I was required to get the vaccine to travel
    - I was pressured to get the vaccine by someone I know
    - I was motivated by incentives by the state government (e.g., lottery)
    - I was motivated by incentives by private corporations (e.g., free donuts)
    - I tested positive for SARS-CoV-2
    - Someone I am close with tested positive for SARS-CoV-2
    - No particular reason- I just changed my mind
    - Other, please specify _____

33. Why did you feel more negative about receiving a COVID-19 vaccine? Select all that apply.
    - I don't think I need the vaccine
    - I am worried about side effects or reactions to the vaccine
    - I am waiting to see how the vaccine affects people like me
    - COVID-19 is not as dangerous as people are saying
    - I do not trust the government or authorities that are telling us to get the vaccine
    - Other, please specify _____

EXPERIENCE WITH COVID-19 VACCINE INFORMATION AND OUTREACH EVENTS

We are now going to ask you about your experiences with COVID-19 information and outreach events at this shelter.

34. Have you ever received COVID-19 vaccine information/materials or attended a COVID-19 vaccine education event at this shelter?
    - No
    - Yes
    - Don’t know

- Prefer not to say

35. How did you receive COVID-19 vaccine information/materials at this shelter?
    - Written informational materials (e.g., pamphlets, flyers, posters)
    - Video
    - Walk-up information booth
    - Question & Answer session
    - Other, please specify _____
36. Who provided this information/material(s) or led this Shelter staff event? Select all that apply.
    - Shelter staff
    - Harborview staff
    - Public health / HEART staff
    - Other, please specify _____
    - Don't know
37. How long ago did this information sharing or event take place? Select all that apply.
    - Spring 2020 (around the start of the pandemic; February-May)
    - Summer-Fall 2020 (June-October)
    - Winter 2020-2021 (around the holidays; November-February)
    - Spring 2021(March-May)
    - Summer 2021 (June-August)
38. Did this information/material(s) or event(s) have an impact on how you felt about COVID-19 vaccines?
    - I felt more positive about receiving a vaccine
    - I felt more negative about receiving a vaccine
    - My feelings about receiving a vaccine did not change
    - Don't know
    - Prefer not to say

<u>COVID-19 VACCINE HISTORY</u>

39. Have you already received at least one dose of the COVID-19 vaccine?
    - Yes
    - No
    - Don’t know
    - Prefer not to say
40. Do you plan to receive a vaccine against COVID-19?
    - Yes
    - No

- Don’t know
- Prefer not to say

41. How many COVID-19 vaccine doses have you received so far?
    - I have already received one dose of the vaccine (one of one-dose series)
    - I have already received one dose of the vaccine (one of two-dose series)
    - I have already received two doses of the vaccine (two of two-dose series)

42. At the time you received the vaccine, was it required of you to continue to attend any work or school?
    - Yes
    - No
    - Don’t know
    - Prefer not to say

43. Is there anything that would change your mind about receiving a COVID-19 vaccine?
    - Yes
    - No
    - Don’t know

44. Have your friends been vaccinated (received at least one dose) against COVID-19?
    - My friends are all vaccinated
    - Most of my friends are vaccinated
    - Some of my friends are vaccinated
    - None of my friends are vaccinated
    - Don't know
    - Prefer not to say

45. Have your family members 12 years or older been vaccinated (received at least one dose) against COVID-19?
    - My family members are all vaccinated
    - Most of my family members are vaccinated
    - Some of my family members are vaccinated
    - None of my family members are vaccinated
    - Don't know
    - Prefer not to say

46. Once there is a COVID-19 vaccine authorized and available for your child's age group, do you think you will…?
    - Get them vaccinated right away
    - Wait a while to see how it is working
    - Only get your child(ren) vaccinated if their school or the shelter requires it

- Definitely not get them vaccinated
- Child(ren) is already vaccinated
- Prefer not to say

DEMOGRAPHICS

Lastly, we are going to ask you some demographic questions (e.g., about your age, race, etc.). This will help us make sure we hear from people with different backgrounds and that everyone's voices are represented.

47. What is your gender?
    - Cisgender man
    - Cisgender woman
    - Transgender man
    - Transgender woman
    - Gender non-binary
    - Other, please specify _____
    - Prefer not to say

48. Are you Hispanic or Latino?
    - Yes
    - No
    - Prefer not to say

49. How would you describe your race? Select all that apply.
    - American Indian or Alaska Native
    - Asian
    - Black or African American
    - Native Hawaiian or other Pacific Islander
    - White
    - Prefer not to say
50. What best describes your marital status?
    - Single
    - Married or living in a marriage-like relationship
    - Separated
    - Divorced
    - Widowed
    - Prefer not to say

51. What is the highest level of education you have completed?
    - Less than high school graduate
    - Graduated high school/obtained GED
    - Some college (including vocational training,associate's degree)
    - Bachelor's degree

- Advanced degree
- Prefer not to say

52. Do you have any of the following health insurance plans? Select all that apply.
    - Employer-sponsored health insurance
    - Individual health insurance purchased outside of employer
    - Medicare
    - Medicaid, Washington Apple Health, or coupons
    - None
    - Other
    - Prefer not to say

53. Where do you usually receive health care? Select all that apply.
    - Doctor's / Nurse Practitioner's office
    - Indian Health Services facility
    - Community clinic
    - Hospital
    - Pharmacy
    - Traditional medicine (cultural home remedies, sobadores, etc.)
    - Family/friends
    - Other, please specify _____
    - Prefer not to say

54. Please choose the range that best represents your household income last year (before taxes).
    - Less than or equal to $25,000
    - Between $25 and 50 thousand ($25,001 to $50,000)
    - Between $50 and 75 thousand ($50,001 to $75,000)
    - Between $75 and 100 thousand ($75,001 to$100,000)
    - Between $100 and 125 thousand ($100,001 to$125,000)
    - Between $125 and 150 thousand ($125,001 to$150,000)
    - Over $150,000
    - Don't know
    - Prefer not to say
55. What best describes your employment status?
    - Full time
    - Part time
    - Day laborer, contract, or temporary work
    - Unemployed
    - Furloughed
    - Other, please specify _____
    - Prefer not to say

56. At your place of work, are employees encouraged to take time off or work from home if they are sick?
    - Yes, and I would be paid for hours missed
    - Yes, but I would not be paid for hours missed
    - No
    - Prefer not to say

57. What is your primary role at this shelter?
    - Volunteer
    - Clinical
    - Case manager or social worker
    - Management
    - Custodial
    - Other, please specify _____
    - Prefer not to say

58. How many children are in your household (or your care)?
    - 1-2
    - 3-5
    - 6 or more
    - Prefer not to say

59. Have you ever been homeless? We consider homelessness to be living without permanent housing (which may include staying with friends, in a hotel, shelter, church, on the streets, in a car, or in any other unstable or non-permanent situation).
    - Yes, in the past
    - Yes, I am currently experiencing homelessness
    - No
    - Don’t know
    - Prefer not to say

60. How long have you been experiencing homelessness?
    - 6 months or less
    - 7-12 months
    - 13-24 months
    - Over 24 months (2 years)
    - Don’t Know
    - Prefer Not to Say

61. How long have you been at this shelter (either as a client or as a staff member)?
    - Less than one month

- 2-6 months
- 7-12 months
- 13-24 months
- More than 24 months (2 years)
- Don’t Know
- Prefer Not to Say

62. Are you interested in speaking further one-on-one with a member of our study staff about your experiences and feelings about COVID-19 vaccines and receive a $20 gift card?
    - Yes, and I can be reached at on a personal cell phone number to take part in a consent call
    - Yes, and I can be reached at the shelter's phone number to take part in a consent call
    - No, I am not interested in speaking further

63. Please confirm the best number that our research team can reach you at to schedule an interview time and date that works.
    - _____

CHAPTER 2B. A QUALITATIVE ANALYSIS OF COVID-19 VACCINATION INTENT, DECISION-MAKING, AND RECOMMENDATIONS TO INCREASE UPTAKE AMONG RESIDENTS AND STAFF IN SIX HOMELESS SHELTERS IN SEATTLE, WA, USA

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Preface

This Chapter contains a manuscript published in the Journal of Social Distress and Homelessness (06 April 2023).[100]

Abstract

COVID-19 vaccines mitigate severe disease, yet uptake remains low among people experiencing homelessness (PEH) despite the risk of transmission in congregate settings like homeless shelters. This study evaluated retrospective COVID-19 vaccination intent and decision-making between March 2020-October 2021 to identify modifiable factors to improve vaccine acceptance among PEH. We conducted 31 semi-structured interviews and eight focus group discussions across six homeless shelters in Seattle-King County, Washington. Residents and staff aged ≥18 years were recruited through purposive sampling for interviews and convenience sampling for focus groups. Thematic analysis was conducted. Participants reported that too much contradictory and changing information about COVID-19 vaccines led to confusion. Information deemed trustworthy contributed to individual's knowledge and in some cases changed their vaccination intent. While many intended to get vaccinated without external motivators, others were motivated by incentives and requirements. Despite intention to vaccinate, participants reported barriers to COVID-19 vaccine access including availability of vaccine doses, timely eligibility for vaccination, and availability of appointments. Participants presented recommendations to improve COVID-19 information content and dissemination, access, and use of incentives in shelter settings. Future research should test recommended vaccination strategies rooted in the voices and experiences of PEH to determine feasibility and effectiveness in shelter settings.

Background

Coronavirus disease 2019 (COVID-19) vaccines are an important tool to mitigate severe COVID-19. However, uptake remains lower among people experiencing homelessness (PEH) than in the general population.[21,74,76,89] People who live or work in homeless shelters are at increased risk for exposure to SARS-CoV-2 given the substantial amount of time spent interacting in a congregate setting.[21,36,73,101] Additionally, developing severe COVID-19 illness is associated with other factors common among PEH.[21,36,73,101] Thus, achieving high COVID-19 vaccination coverage in homeless shelters is critical to reduce transmission, morbidity, and mortality.[21,74] Previous studies have highlighted disparities in COVID-19 vaccination intent and uptake among PEH in the United States (U.S.). For example, between February 2021 and August 2021, a study in Seattle-King County found that vaccine acceptability was lower among sheltered PEH and shelter staff than the general population. Most participants in this repeated cross-sectional study indicated a change in intent or decision to receive COVID-19 vaccination over time.[21,75,76]

Information is lacking about how to improve COVID-19 vaccine uptake among PEH since the widespread availability of COVID-19 vaccines. Previous studies identified that among PEH, vaccine acceptability was linked to a desire to return to routine life and civic responsibility,[89] or to protect one's family, friends, and community.[75] Vaccine hesitancy has been linked to mistrust of the government and a desire for more information about vaccine ingredients and long term effects, such as data from randomized clinical trials.[75,89] These previous findings highlighted that reasons for

hesitancy among PEH are similar to those expressed by the general population.[75,89,102–105] However, vaccination campaigns, messaging, and interventions need to be tailored for PEH to ensure the highest possible vaccine coverage.[75]

This study aimed to describe retrospective information about perceptions of and intent to receive a COVID-19 vaccination among shelter residents and staff over time between March 2020 and October 2021, as well as to identify modifiable factors and recommendations to improve vaccine acceptability among PEH.

Methods

Study design and population

We conducted qualitative semi-structured interviews ("interviews") and focus group discussions ("focus groups") to explore factors that may influence COVID-19 vaccination intent and decision-making among PEH. This study represents the second part of a two-phased, sequential explanatory design of quantitative, followed by qualitative, data collection. Quantitative methods and findings from point-in-time (PIT) surveys conducted between 12 July 2021 – 2 August 2021 are presented elsewhere.[72] We used quantitative PIT survey data for hypothesis testing, expanding upon results by qualitatively highlighting the voices of PEH. We connected the data sets by identifying participants from the PIT survey for the interview sample. Additionally, we used the technique of building, (i.e. where results from one data collection procedure inform another data collection approach) to refine interview and focus group guides.[106,107]

Typology development, with categories identified from the PIT surveys, informed the qualitative thematic codebook for analysis.[108,109]

We conducted interviews and focus groups with residents and staff across six homeless shelters in Seattle-King County, Washington from 27 July 2021 to 14 October 2021, to learn about perceptions of and intent to receive a COVID-19 vaccination between March 2020 and October 2021. We employed multiple methods (i.e. interviews and focus groups) and data sources (i.e. residents and staff) to triangulate perspectives and test validity through convergence of information within shelters.[110–112] While interviews allowed for privacy in sharing sensitive information and personal health decisions, focus groups stimulated interaction and allowed participants to hear each other's responses and provide additional comments that they might not have made individually.[110]

Shelter sites were selected to be sociodemographically representative of King County's sheltered PEH[13] and included two mixed-gender adult shelters (aged ≥18 years), two family shelters (all ages), one all-male older adult shelter (aged ≥50 years), and one young adult shelter (aged 18–25 years). The study team had established relationships with residents and staff at each shelter site through engagement with the Seattle Flu Study (SFS), previously described.[22,23] Individuals aged ≥18 years whose primary residence or place of employment was at one of these six shelters were eligible for participation. All participants were provided a $20 gift card to compensate for their time and effort.

Participant recruitment

Interview participants were identified purposively through prior PIT survey participation to ensure a diverse mix and representative sample of COVID-19 vaccine attitudes and demographics. This included prioritizing non-English speakers, those who did not identify as cisgender, individuals with children, those with changes in COVID-19 vaccine intention over time, or those who were undecided or not planning to get a COVID-19 vaccine at the time of their PIT survey. Efforts were also made to ensure interview and focus group participants were racially and ethnically diverse. Study staff contacted participants and conducted interviews with them on-site between 27 July 2021 – 14 October 2021. Focus group participants were recruited through convenience sampling among residents who had not already participated in an interview and were conducted between 27 August 2021 – 6 October 2021. Focus groups were announced and advertised at shelter sites by the study team or shelter staff 1–3 days prior. Participants who had not previously completed a PIT survey were asked to complete a modified survey to capture demographic information prior to the interview.

Data sources and collection

We utilized the Health Belief Model (HBM)[113,114] and the Confidence, Complacency, Convenience (3Cs) Model of Vaccine Hesitancy[115] to develop a modified conceptual framework and interview guides to understand factors that may influence COVID-19 vaccination intent and decision-making among PEH over time (Figure 2.B.1). The HBM posits key constructs that predict health behavior, including perceived susceptibility, severity, benefits to action, barriers to action, and self-efficacy.[113,114] The 3 Cs model

highlights three contributing factors to vaccine hesitancy: complacency, convenience, and confidence.[115]

Interview and focus group guides were developed by the study team in partnership with stakeholders from Public Health Seattle-King County (PHSKC) and people with lived experience of homelessness (Appendix A:B). The guides were piloted internally by the study team for flow and length. Interview guides were then translated into Spanish, French, Amharic, and Tigrinya. We captured retrospective information about perceptions of and intent to receive a COVID-19 vaccination between March 2020 and October 2021.

Interviews and focus groups took place in private rooms in the participating shelters. Interviews were conducted by one University of Washington (UW) team member and focus groups were conducted by two UW team members – one facilitator and one note taker – all of whom introduced themselves as UW researchers to participants. All interviews and focus groups were audio recorded and kept confidential. Brief memos with field notes were developed within 24 h for each interview or focus group. These were summarized and presented back to the research team weekly and referred to during coding as needed. Audio files were processed by a transcription service (Dynamic Language) every other week, allowing for timely coding. Interviews conducted in another language were translated to English prior to coding and reviewed in detail by the staff who conducted the interview to ensure accuracy. Transcripts were not returned to participants for comment or correction. This study was approved by the Human

Subjects Division of the UW Institutional Review Board (STUDY00007800: See 45 C.F.R. part 46; 21 C.F.R. part 56.).

Analysis

Thematic analysis was conducted using Dedoose Version 9.0.17.[116] The codebook (Appendix C) was developed collectively by the analysis team. Data were coded using both a deductive (i.e. codes developed *a priori* through the conceptual framework) and inductive (i.e. new data-driven codes added as needed) approach. We used in vivo coding to maintain the integrity of our data. For example, we list vaccine information sources stated explicitly by participants (e.g. CNN) rather than using generic groupings (e.g. news outlets). Additionally, we completed coding iteratively as interviews were transcribed between 24 August 2021–18 November 2021. Once thematic saturation became evident in codes through identifying repeated responses, we made modifications to the interview guides (e.g. in later interviews focused less on healthcare experiences and more on vaccination intent).

The first four interview transcripts and first two focus group transcripts were coded in pairs to ensure consistent understanding and use of the codebook. Approximately one-third of additional transcripts (36%, n = 12/33) were peer reviewed by another coder. Coders met one to two times per week to discuss coding questions and interpretations to reach consensus with oversight and support from the qualitative Principal Investigator. We evaluated common codes across cases and primarily used cutting and sorting as a processing technique to group similar codes and develop themes. Themes

were refined by group discussion and descriptive quotes were selected by group consensus. Trusted versus mistrusted COVID-19 vaccine information sources identified by participants were used to create a word cloud, with the size of the phrase representing the number of times it was mentioned. As there was not always consensus on the strategies to improve COVID-19 vaccine uptake, we present recommendations for shelter settings that optimize usability by a wide audience while being mindful of participant preferences.

Positionality

In the spirit of reflexivity, the analysis team acknowledges the role that our socioeconomic positions and experiences may contribute to data presentation and interpretation. Among team members, there is some familial and personal lived experience of homelessness, as well as extensive experience conducting vaccine research and public health practice to improve health equity in Seattle-King County. The coding team consisted of four team members each with master's degrees in public health. At the time of analysis, one female was working as a CDC researcher, while one male and two female researchers were working at the UW. All members of the coding team had previous experience conducting qualitative studies, and two had previous experience coding. All but one coder had experience at shelter sites conducting a portion of interviews and focus groups.

Results

We conducted 31 interviews (25 residents and six staff) and eight focus groups with 43 residents (Table 2.B.1). The average length of each interview was approximately 44 min (range: 10-90 min). Focus groups averaged 68 min in length (range: 52-111 min). Among interview participants, 61% (n = 19) reported any COVID-19 vaccination and 29% (n = 9) reported no COVID-19 vaccination at the time of their interview (n = 2 “Don’t know”; n = 1 “Prefer not say”). Of the shelter staff participants, three out of the six indicated previous experience with homelessness. Themes that emerged from interviews and focus groups are presented in three sections below: (1) vaccine perceptions and COVID-19 vaccination decision-making, (2) factors influencing COVID-19 vaccination intent and decision-making, and (3) participant recommendations for interventions to improve vaccine uptake among PEH.

1. Vaccine perceptions and COVID-19 vaccination decision-making

In this section, we describe positive and negative vaccine perceptions and elucidate reasons for COVID-19 vaccine acceptance or reluctance among shelter residents and staff.

1.1. Perceptions of vaccines in general and COVID-19 vaccines

We highlight perceptions about *vaccines in general (italicized)*, **COVID-19 vaccines (bolded)**, and both ***vaccines in general and COVID-19 vaccines (italicized and bolded)*** as expressed across shelter participants (Figure 2.B.2). Supportive quotes are presented in Appendix D1. Positive vaccine perceptions included that they were

effective, safe, necessary, and widely embraced, while negative perceptions included that vaccines were not necessary, for-profit, had been rushed in development, and developed with malicious intent. These perceptions were congruent between residents and staff with both groups describing similar positive and negative perceptions. Figure 2.B.2 illustrates how general vaccine perceptions and COVID-19 vaccine perceptions overlapped, however we found that these did not always align among individuals themselves (Appendix D1).

- 1.1.1. Positive perceptions
    - *Accessible*: Vaccines came at no cost and were available nearby (e.g. at school).
    - *Normal*: Vaccines were standard and something everyone did in both childhood and adulthood.
    - ***Effective***: Vaccines were reliable at reducing chances and severity of severe disease.
    - ***Necessary***: Vaccines were essential to prevent illness, community spread, and achieve herd immunity.
    - **Safe**: Vaccines were extensively researched (e.g. mRNA technology is not new) and show no harm.
    - **Widely embraced**: Most people in Seattle, WA, USA were vaccinated against COVID-19, influencing others to get vaccinated.
- 1.1.2. Negative perceptions.
    - *Experimental*: Vaccines were still being tested and some people were being used as “guinea pigs” in experiments.

- *Anxiety provoking*: Needles were disliked, hated, or scary, sometimes due to drug use.
- *Harmful*: Vaccines caused negative reactions or side effects ranging from temporary pain to longer term health consequences.
- *Forced*: Vaccination was sometimes imposed through tactics such as brainwashing or restraint, especially in childhood.
- ***Not necessary***: There was no need for vaccines given strong natural immunity.
- ***For profit***: Vaccines were developed to make money and profits and pushed by propaganda; resulting in some individuals not being worth protecting or needing to travel far for equitable care.
- ***Rushed development***: Limited research prior to vaccine distribution could lead to side effects for individuals receiving COVID-19 vaccines or other vaccines in general. Vaccine ingredients were unclear and effectiveness in different populations was questioned.
- **Not effective**: One could still get sick even when vaccinated and wearing masks, indicating that the COVID-19 vaccine does not work.
- **Malicious intent**: The COVID-19 vaccine was developed with the intent to harm individuals, such as infecting people with latent disease to make them ill in the future or controlling the minds of recipients and tracking their activities.

1.2. Reasons for COVID-19 vaccination decision-making

We also elucidated reasons for decision-making about whether or not to receive a COVID-19 vaccine among shelter participants (Appendix D2). Reasons to get vaccinated consisted of fear of poor health outcomes, desire to protect others, desire for day-to-day life and community behaviors to return to normal, and requirements for work or to participate in social gatherings. Reasons not to get vaccinated included uncertainty of long-term effects, reliance on natural immunity, competing demands, mistrust, religious beliefs, and individual-level concern and superiority. While vaccine perceptions contributed to COVID-19 vaccination intent, these were not directly linked – in particular, many with negative perceptions were vaccinated. Additionally, a minority of individuals who were originally vaccinated against COVID-19 later felt skeptical of booster doses or even described regretting their decision to be vaccinated given that they still got COVID-19 despite being vaccinated. Furthermore, some participants noted frustration stemming from the booster requirement as it was not part of the original health messaging and having to continue to follow the same prevention measures as the unvaccinated (e.g. masks, social distancing). While some vaccinated individuals questioned if they made the right decision, some unvaccinated individuals remained steadfast in their position.

- 1.2.1. Reasons to get vaccinated.
    - **Fear of poor health outcomes**: Participants expressed concerns of the negative impact of illness if not vaccinated, sometimes influenced by personal risk factors or past experiences with COVID-19.
    - **Desire to protect others**: To keep others safe, especially family and others in shelter or hospital.

    - **Desire to "return to normal"**: To minimize COVID-19 prevention and control measures, including restrictions such as lockdown and masks.
    - **Requirement**: Required for work or to participate in social gatherings.
- 1.2.2. Reasons not to get vaccinated.
    - **Uncertainty of long-term effects**: Need for more time to see research and side effects.
    - **Reliance on natural immunity**: Feeling healthy and not affected by COVID-19 or do not believe COVID-19 is real.
    - **Competing demands**: Daily stressors of homelessness prevented some from having the capacity to worry or think about COVID-19 vaccination.
    - **Mistrust**: Government and media mistrust and fear of tracking or unsafe ingredients.
    - **Religious beliefs**: Strong religious beliefs, such as COVID-19 vaccines being the "mark of the beast."
    - **Individual-level concern and superiority**: Belief of supremacy above others (e.g. "white supremacy") and focus on individual-level concerns rather than community-level concerns

2. Factors influencing COVID-19 vaccination intent and decision-making

In this section, we describe three modifiable factors that influenced COVID-19 vaccination intent and decision-making, including information dissemination and content, access to vaccination, and incentives & requirements for vaccination.

2.1. COVID-19 vaccine information dissemination and content

Information from trusted sources contributed to individuals' knowledge, and in some cases change in vaccination intent and decision-making. Residents and staff obtained COVID-19 vaccine information through different modalities including one-on-one interactions, print materials, digital information, and alternative news sources. Commonly trusted sources of COVID-19 vaccine information included healthcare providers, government staff and agencies, friends, family, community members around them, and some news and media sources; commonly cited mistrusted COVID-19 vaccine information sources included social media, the internet, and some government agencies. There was a general mistrust for sources and persons who were either unknown to the respondent, carried unverified information or untrusted due to other issues like politics (e.g. strangers, some scientists, non-medical professionals, President Trump, Fox news). Figure 2.B.3 illustrates trusted and mistrusted sources, with larger words representing the more frequently mentioned sources.

Participants reported that too much contradictory and changing information about COVID-19 vaccines led to confusion. Additionally, perceived mishandling of information (e.g. deception, government mismanagement) or anything that appeared to be tied to money were not trusted. COVID-19 vaccine information that was seen as objective, honest, professional, and recommended by others were deemed trustworthy by participants (Appendix D3). Trusted COVID-19 vaccine information sources sometimes contributed to individual's knowledge and in some cases were noted as a reason for change in an individual's vaccination intent. This change in COVID-19 vaccination intent

was most common after recommendation during one-on-one interactions with trusted family, friends, or providers (Appendix D3, 2.1.3.)

- 2.1.1. Used sources.
    - **One-on-one interactions**: Individuals sought information from persons or institutions whom they thought had relevant COVID-19 information. These included healthcare providers, government agencies staff, shelter staff, family, friends and community members around them.
    - **Reading print materials**: Materials available for residents or members of the public were other sources used. These included flyers, leaflets and medical journals.
    - **Online sources**: Others chose online resources to get COVID-19 information. This was either by targeting specific health-related websites or social media accounts run by health care providers or other professionals, or by performing searches and clicking on pop-ups related to COVID-19.
    - **Alternative news**: There were also alternative news and information sources run by individuals. These included podcasts and YouTube streamers.
    - **Multiple sources**: Other people chose to combine all the listed sources to get comprehensive information.
- 2.1.2. Trusted vs. mistrusted sources.
    - **Trusted**: Healthcare providers, medical professionals, government staff and agencies, friends, family, community members around them, print news, TV News, and online sources.
    - **Mistrusted**: There was a general mistrust for sources and persons who were either unknown to the respondent, carried unverified information orwere untrusted due to other factors (e.g. conflicting political stance). These included

non-medical professionals, some government agencies, celebrities, President Trump, strangers, internet sources, and Fox news.

- 2.1.3. Reasons for trust.
    - **Recommended by others**: Trusts the source because others trust the source, provides useful information.
    - **Objective**: Source was perceived to be accurate and forthcoming.
    - **Honest**: Source was able to admit when unsure or previously wrong, or were perceived to be telling the truth.
    - **Professional**: Source had training, experience, and authority in the topic.
- 2.1.4. Reasons for mistrust.
    - **Inconsistent**: Source had contradictory, changing, non-transparent, or seemingly “fake” information.
    - **Mishandling**: Perceived government mismanagement, deception and anything seen as propaganda.
    - **Money**: Information presented for profit making purposes.

2.2. COVID-19 vaccine access

Participants described four factors that contributed to accessibility of COVID-19 vaccines (Appendix D4). Despite intention to vaccinate, barriers to any of these factors could prevent someone from receiving timely COVID-19 vaccination.

- **Cost**: Getting COVID-19 vaccines was easy because it was free.
- **Availability**: Many different locations with vaccines, in close proximity to the shelter, improved ability to get vaccinated.
- **Eligibility**: Broader eligibility criteria made it easier to access vaccines; initial delays in COVID-19 vaccine rollout and limited eligibility was restrictive for some and made it difficult to get vaccinated as early as one initially wanted.

- **Appointments**: Finding COVID-19 vaccine appointments nearby and navigating appointment systems were challenging, especially early during vaccine rollout.

2.3. Incentives and requirements for COVID-19 vaccination

While many participants were motivated to get vaccinated to protect themselves and those around them, others were motivated by incentives and requirements. Physical incentives included items, such as money, gift cards, food, and clothing. Others were incentivized by time-off from work or childcare while they got vaccinated or recovered from side effects. Requirements were identified as a motivator to get vaccinated, however most believed incentives or encouragement were enough and that requirements should only be mandated when absolutely necessary. Discussion of vaccine mandates did not specifically address implementation within the shelter setting, but instead considered their broader use and implications for society (Appendix A:B). COVID-19 vaccine mandates were a notable point of debate in focus groups, especially among residents in family shelters when considering the impact of these mandates on their children (with arguments both for and against). Extra encouragement for COVID-19 vaccination among those in communal living settings was discussed, including monetary incentives. While both residents and staff primarily emphasized monetary incentives, residents provided a wide array of additional incentives that could be offered. Supportive quotes are presented in Appendix D5.

- **Money**: Cash was reported as a practical incentive, with anywhere between $20-$1,000 needed to change someone's mind about receiving a COVID-19 vaccine. Gift card vouchers to companies like Amazon were suggested, as well as government lotteries

with cash prizes. However, a minority of participants felt that money was a bribe or that large sums of money would be needed to get the vaccine.

- **Food**: Hot meals (e.g. a barbeque, lunch at a restaurant) and desserts (e.g. donuts) encouraged COVID-19 vaccination.
- **Housing and other goods**: Private housing, clothing (especially to keep warm), as well as other goods (e.g. car, marijuana) contributed to COVID-19 vaccination.
- **Paid time-off work and childcare**: Ensuring no loss of pay and adequate childcare was critical to getting vaccinated.
- **Relief from lockdowns, masking**: Beliefs that COVID-19 vaccination would reduce need for social distancing and other interventions (e.g. masks) contributed to COVID-19 vaccination.
- **Requirement for public-facing jobs, school**: Requirements for certain employment that involves direct interaction with the public (e.g. teachers, healthcare workers, airport workers) increased COVID-19 vaccination.
- **Extra incentives in communal living settings**: Some participants stressed the importance of additional incentives to motivate those in congregate settings to get vaccinated against COVID-19.

3. Participant recommendations for interventions to improve vaccine uptake in shelter settings

Participants provided recommendations to improve COVID-19 information content and dissemination, access to COVID-19 vaccination, and incentives for vaccinating in shelter settings (Table 2.B.2). Commonly cited suggestions specific to COVID-19 vaccine information delivery included repeated verbal and written messaging tailored to the local context, as well as specific resources relative to the shelter location. While

limited vaccine accessibility initially hindered vaccination for many, interventions that improve the convenience and opportunities for choice of vaccine manufacturer could change intent to be vaccinated among some who are still undecided.

Most participants stated that incentives, such as money, food, shelter, clothing, and paid time-off needed for vaccination and recovery, would increase acceptability. However, it is important to note that a minority of participants expressed a strong position against COVID-19 vaccination and found incentives to be coercive. Presented recommendations for incentives and requirements are thus specific to those who are undecided.

Since daily challenges of residing or working in a homeless shelter can outweigh the urgency to be vaccinated, some participants highlighted that the need to find new housing, work, or take care of children often played a larger role in day-to-day decision-making. New suggestions from participants to facilitate COVID-19 vaccination amidst competing demands include reliable shelter transport to vaccination sites, childcare during vaccination and recovery, and having a staff member who is a COVID-19 ambassador at the shelter site whom residents could rely on for up-to-date information and local resources. During focus groups, there was considerable agreement among residents about the benefits of incentives to increase COVID-19 vaccine uptake, regardless of whether this influenced a participants own decision-making. Recommendations from shelter residents and staff presented in Table 2.B.2 could help

to increase vaccine uptake among those who are undecided about COVID-19 vaccination.

Discussion

In this qualitative study with interviews and focus groups, we found that the decision to get vaccinated against COVID-19 is complex with multiple nuanced factors at play, suggesting a need for multi-level interventions to improve vaccine uptake in congregate shelter settings. Participants described their decision-making processes, emphasizing their agency and opportunities for interventions, which program implementers and policy-makers could consider for future COVID-19 or other vaccine campaigns. Although a majority of individuals quantitatively reported increasing vaccine acceptance over time,[72] a surprising result was that the path to decision-making and COVID-19 vaccine acceptance was not always clear. Sometimes decisions were clearly linked to perceptions or sources of information. However, a few vaccinated participants expressed negative COVID-19 vaccine perceptions, demonstrating that vaccination may not be an indicator of acceptability, but rather compliance to social norms or requirements. A minority of participants held steadfast in their COVID-19 vaccination intent and incentives did not influence them to get vaccinated. Our discussions highlighted that special considerations in a shelter environment, such as competing demands in the day-to-day life of those residing or working in a homeless shelter, can outweigh the urgency to be vaccinated.[117–119]

Our study came at a critical time after widespread COVID-19 vaccine availability to develop practical recommendations to improve vaccine implementation, which are rooted in the voices and experiences of PEH and shelter staff. Building upon established relationships with shelters prior to and throughout the COVID-19 pandemic, we were able to obtain a demographically diverse sample of participants. The inclusion of qualitative staff interviews allowed for theme triangulation and highlighted congruency with resident interviews, akin to quantitative similarities seen in COVID-19 vaccination intent in quantitative PIT surveys.[72] Additionally, as half of shelter staff participants indicated first-hand experience of homelessness, the inclusion of this population allowed for nuanced perspectives and continuity between those with personal lived experience of homelessness and those who work closely with residents in congregate settings. Similar to previous studies among PEH, we observed the importance of relaying simple, clear and pertinent information through a mixture of varied platforms, such as paper-based and electronic materials, media, and social outreach (e.g. word of mouth from peers, family, homeless services, and healthcare providers).[118,120–124] We build upon this prior work by highlighting the value of reiterative and trusted messaging and information specific to the local context (e.g. where, when, and how to get vaccinated relative to a shelter location). Information deemed trustworthy (i.e. objective, honest, professional, and recommended by others) contributed to individual's knowledge and in some cases, a change in their vaccination intent. We also identified trusted sources for information and reasons for trust which can be helpful for future generation of content and dissemination of COVID-19 vaccine educational materials. Trusted COVID-19 vaccine information sources were similar to those previously

identified by other communities that have been historically marginalized in the U.S. and incarcerated populations in Canada, and included doctors, researchers, known trusted figures, and local community leaders.[125,126] In terms of access, many participants cited the importance of vaccines being free of charge, which has previously been noted as one of the biggest barriers to other vaccine uptake for PEH.[127] Increased availability through pop-up or on-site vaccination was especially important.[128,129] We also found that offering vaccine choice and providing easier options to sign-up or drop-in for vaccination that minimize red tape (e.g. not requiring identification) are critical. While incentives have been identified as beneficial,[118] we shed light on details suggested by shelter participants in the context of COVID-19 (e.g. money, food, clothes, housing, paid-time off) and the importance of ensuring incentives are not perceived as bribes and only requiring vaccination when absolutely necessary as shown in other public health interventions.[130]

Individuals' beliefs about vaccines in general did not always align with perceptions of COVID-19 vaccines. For example, many with negative perceptions about vaccines in general were also vaccinated against COVID-19. Additionally, some COVID-19 unvaccinated individuals acknowledged benefits of vaccination in general. We hypothesize that this tension highlights room for more authentic conversation between shelter residents and staff with trusted medical professionals to explore root ideas a person may have about COVID-19 vaccines and other vaccines. Conversations likely need to be tailored to be vaccine and disease specific. While an individual will ultimately make their decision about COVID-19 vaccination on their own, conversations that

respect personal agency may play a critical role for someone to become more positive about COVID-19 vaccination. Findings from this study highlight malleability as encouragement from peers, family, health care providers, community and religious leaders are often recognized as contributors to a person feeling increasingly positive about vaccination.[72]

Additionally, while most study participants were motivated to get vaccinated on their own, many identified incentives as helpful, especially in a shelter setting with so many competing day-to-day stressors. However, a minority of participants voiced that incentives sometimes felt like a bribe and disincentivized vaccination. It is important to emphasize that these were not agreed upon by everyone. We opted to include incentives in these recommendations, but future implementation research is essential to determine public implications (e.g. at what point are incentives motivating versus coercive). Views from residents and staff about whether requirements and mandates should be utilized to increase COVID-19 vaccine uptake varied. Lack of clear consensus is consistent with previous literature concerned with potential negative impacts,[131] and thus we advise that these measures should be reserved for use only in exceptional situations when no other options are available (e.g. public-facing jobs that interact with others at high risk of severe disease, such as healthcare personnel). Such contradictions are typical of societal change and can be especially salient in the realm of preventative health and decision-making. Alternative strategies may be needed for those who remain strongly against COVID-19 vaccination.

Based on our findings, we propose approaches to reduce communication gaps and improve COVID-19 vaccination uptake among sheltered PEH. Specifically, we present recommendations for COVID-19 vaccine information (i.e. content, dissemination), access, incentives and requirements. While these are tailored to a U.S. urban shelter context based on interviews conducted in a single U.S. county, they may be applicable to other urban cities experiencing similar challenges. The disproportionate COVID-19 vaccine uptake among PEH and general population (75% versus 91%)[72,87] threatens to leave a population that has already been marginalized even more at high risk for severe COVID-19 infection and sequelae. Our study offers insights into efforts needed to improve confidence and coverage of COVID-19 vaccines among PEH, but continued efforts are critical to promote receipt of additional COVID-19 vaccine doses to overcome waning immunity and emerging viral variants.[132] Stakeholders such as shelter management, public health officials, and health care providers, can utilize these findings to inform and test new COVID-19 vaccination interventions among PEH. Our work has important practical implications and provides grounds for future research to understand vaccine decision-making and how to improve uptake during an outbreak or pandemic.

Strengths and limitations

Our data reflect the experiences of homeless shelter residents and staff in a single urban metropolitan city and thus the experiences of other PEH (e.g. unsheltered; rural) will not necessarily be the same. As unsheltered individuals are often less connected to services and case management compared to those residing in shelters,[133,134] findings may not be applicable to unsheltered PEH. However, our study has the advantage of

drawing on individuals across a wide array of different types of shelters where study staff had established relationships prior to the COVID-19 pandemic. Additionally, some shelter residents had experienced homelessness in other parts of the country, providing a diversity of views. While we were only able to recruit two non-English speaking residents to participate in interviews, both emphasized gratitude for the safety and ease of access to COVID-19 vaccines in Washington state as compared to other states and countries. This contributed to their vaccine acceptance and was in direct contrast to previous negative experiences and barriers to accessing services which they speculated was due to their Hispanic identity or immigrant status. Additional data from non-Native English speakers is important to inform how cultural orientation may shape COVID-19 and COVID-19 vaccination decisions. Selection bias may be present as participation in interviews and focus groups were voluntary. As participants were selected to provide a diversity of vaccine perspectives, data presented are not representative of the entire population (e.g. cannot be used to determine the proportion of certain perspectives or vaccine acceptance in shelters). As high levels of distrust of health care providers and low rates of health care use in homeless populations have been documented,[97–99] perspectives of study participants may not reflect those unwilling to participate and interact with study staff. Given our small sample size of shelter staff, and potential social and structural differences between residents and staff, future research could explore nuances between these groups as this was beyond the scope of this analysis. Emphasis of different topics within the interview guides dependent on thematic saturation levels allowed flexibility to probe longer where more information was needed; however this resulted in not all participants answering all questions (if

saturation was already reached). Information bias may also be present due to self-report, such as social desirability bias, and recall bias in remembering change in attitudes over time. To mitigate this limitation and reduce potential misclassification, we provided verbal and written assurances that data would remain anonymous and used timeline cards and seasonal cues to help with memory.

Conclusion

COVID-19 vaccination strategies that are rooted in the voices and experiences of sheltered PEH are presented and can inform improved vaccine implementation among shelter management, public health officials, and health care providers. To improve vaccination coverage in shelter settings vaccine information should be transparent, easily visible, specific to the local context, and delivered by trusted messengers, such as healthcare providers or shelter management. Vaccine access can be improved by providing transportation to vaccination sites or bringing vaccines to shelter sites, as well as allowing drop-ins and offering a choice of vaccine type when possible. Additionally, incentives (e.g. money, food, clothes, paid time off work, childcare) are critical and should be used especially given many completing demands among those in homeless shelters. Future research should test these multi-level recommended strategies to determine feasibility and effectiveness in shelter settings.

Tables and Figures

Table 2.B.1. Participant characteristics

Participant characteristics	Total (N=74)		Interviews		Focus groups
	N	(%)	*Residents* (n=25)	*Staff* (n=6)	*Residents* (n=43)
Participants per shelter site					
Adult mixed 1	**19**	**26%**	4	2	13
Adult mixed 2	**14**	**19%**	3	2	9
Mixed family 1	**11**	**15%**	4	0	7
Mixed family 2	**5**	**7%**	4	1	0
Older adult male	**14**	**19%**	4	1	9
Young adult	**11**	**15%**	6	0	5
Gender					
Cisgender man	**43**	**58%**	12	3	28
Cisgender woman	**20**	**27%**	7	2	11
Transgender man	**1**	**1%**	1	0	0
Transgender woman	**0**	**0%**	0	0	0
Non-binary	**6**	**8%**	3	1	2
Other	**2**	**3%**	1	0	1
Prefer not to say	**2**	**3%**	1	0	1
Age group					
18 - 49 years	**40**	**54%**	16	2	22
50 - 64 years	**24**	**32%**	5	2	17
65 and older	**10**	**14%**	4	2	4
Race					
American Indian or Alaska Native	**1**	**1%**	1	0	0
Asian	**1**	**1%**	0	1	0
Black or African American	**26**	**35%**	6	4	16
Native Hawaiian or other Pacific Islander	**3**	**4%**	1	0	2
White	**30**	**41%**	10	1	19
Multiracial	**5**	**7%**	2	0	3
Prefer not to say	**8**	**11%**	5	0	3
Hispanic ethnicity					
Yes	**7**	**9%**	2	2	3
No	**63**	**85%**	21	4	38
Prefer not to say	**4**	**5%**	2	0	2
Primary language					
English	**72**	**97%**	23	6	43
Spanish	**2**	**3%**	2	0	0

Table 2.B.2. Recommendations for interventions to increase COVID-19 vaccine uptake in shelter settings

COVID-19 Vaccine Information	**COVID-19 Vaccine Access**	**COVID-19 Vaccine Incentives & Requirements**
Information content ● Simplify message ● Provide details on side effects, what vaccine does in body ● Clarify numbers (without complex statistics) ● Do not generalize or ostracize demographic groups ● Highlight importance in communal living settings ● Be transparent with research motives ● Frame as choice, without threatening language *Information delivery to residents* ● Reiterate message ● Provide paper-based materials ● Make available in other languages ● Post information where visible in shelters ● Shelter staff or management provide direct information ● Build rapport and compassion ● Engage residents in discussion ● More educational events at shelter ● Show COVID-19 documentary ● Encourage talking to health care providers ● Clarify where, when, and how to get vaccinated relative to shelter location ● Restrict posting of misinformation; teach how to discern correct versus incorrect information *Information delivery to staff* ● Provide regular information and training to staff on how to connect residents to resources ● Communicate both verbally and written	● Bring vaccine and health services to shelters, with more convenient, reliable availability ● Allow for drop-ins ● Pop-up sites near community, shelter ● Provide transport to vaccination sites ● Offer choice of COVID-19 vaccine type (e.g., Pfizer, Moderna, J+J) and boosters ● Improve interface for appointment sign-ups ● Schedule second dose at first vaccination if desired ● Minimize red tape (e.g., not require identification for undocumented individuals)	*Incentives* ● Money or gift cards ($20-$100+) ● Food (e.g., donuts, meals) ● Clothes ● Housing ● Paid time-off work and childcare to get vaccinated, recover *Requirements* ● Only mandate when necessary

Figure 2.B.1. Conceptual framework of COVID-19 vaccination intent and decision-making among people experiencing homelessness

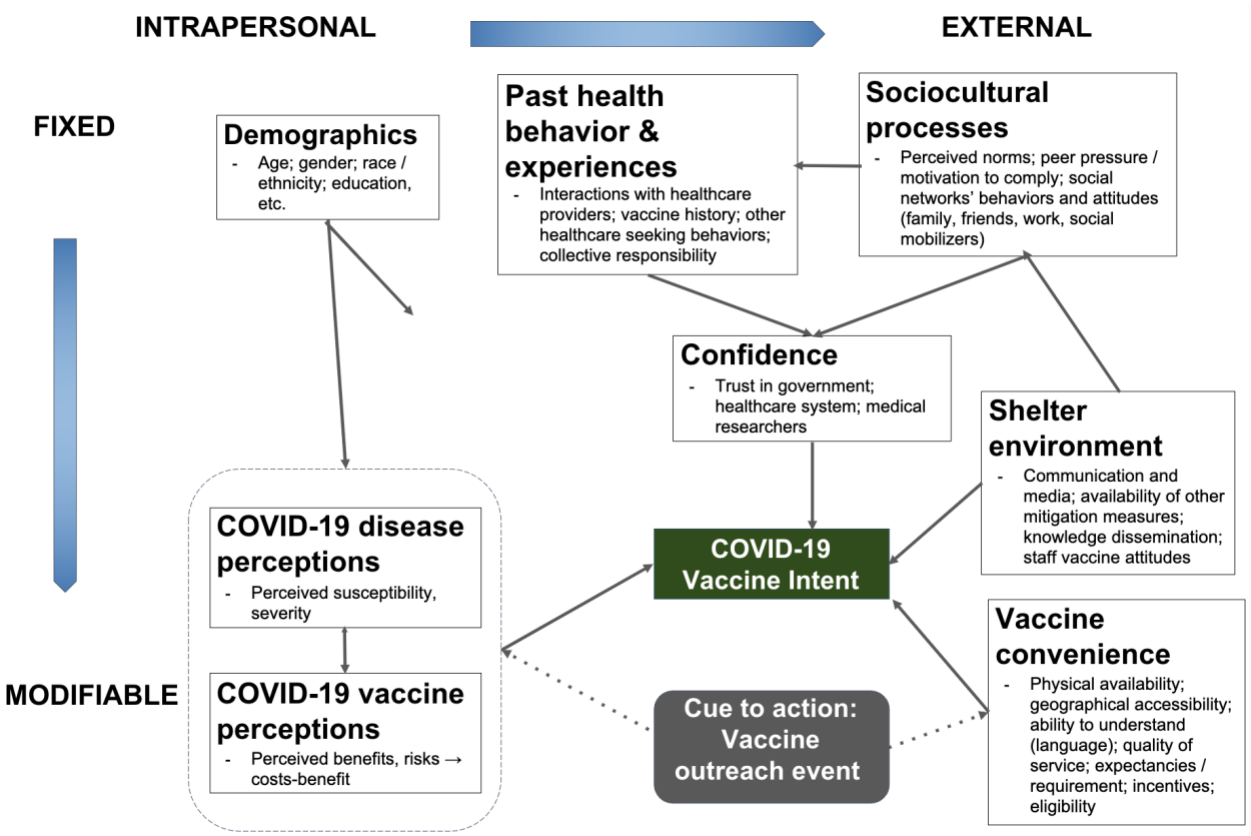
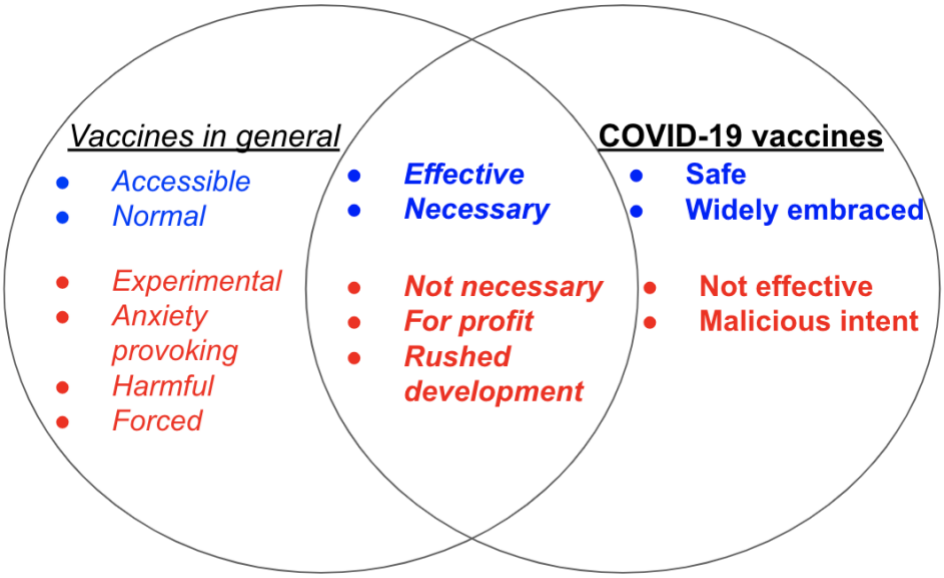


Figure 2.B.2. Venn diagram of perceptions of vaccines in general and COVID-19 vaccines



* Positive vaccine perceptions (blue), negative vaccine perceptions (red). Perceptions about *vaccines in general (italicized)*, **COVID-19 vaccines (bolded)**, and both ***vaccines in general and COVID-19 vaccines (italicized and bolded)***.

Figure 2.B.3. Word cloud of COVID-19 vaccine information sources

*Trusted COVID-19 vaccine information sources (blue), mistrusted COVID-19 vaccine information sources (red)

Appendix Materials

Appendix A1. Interview Guide – English

Hello, my name is_____, I work with the [DEIDENTIFIED] Seattle Flu Study. Today we want to talk with you to learn about your thoughts and experiences with healthcare. Specifically, we want to know more about COVID-19 vaccination. We will also do about 29 interviews with other people in Seattle King County shelters. We value your opinion. It will help us better understand feelings and experiences with COVID-19, vaccines, and COVID-19 vaccines. It will also help us understand how vaccines can play a role in keeping you and your community healthy.

REVIEW WRITTEN CONSENT FORM AND RECEIVE AUDIO/VISUAL CONSENT. THANK ANYONE WHO DECIDES NOT WANT TO PARTICIPATE.

Our conversation today will take about 30-60 minutes. With your permission, I would like to record our conversation today. We try to take notes, but they are not always complete. If you want to make a comment that you don't want recorded, tell me and I will turn off the recorder. I will then re-start it when you finish making your comment. Is that OK?

Please remember that anything we say here today is confidential. What you share with me will be combined with the information from other participants. That way no one will know what you said as an individual. Do you have any questions before we begin?

- START THE VIRTUAL RECORDER -

[INTERVIEWER ASSIGN AND STATE UNIQUE IDENTIFIER AT THE BEGINNING OF THE RECORDING E.G., "SSI_OP_TM_2021-06-25"]

We will now begin. Can you confirm that you agree to be audio recorded?

1. GENERAL QUESTIONS ABOUT HEALTH SYSTEM PERCEPTIONS AND SEEKING HEALTHCARE

I am going to start with general questions about your experiences with healthcare.

a) Can you tell me where you go most often when you get sick or need healthcare?
b) Can you describe your most recent experiences getting healthcare services? **Probe:**
   - Have they been positive or negative experiences?
c) **[REFER TO NEGATIVE EXPERIENCES IF MENTIONED IN 1B]**. Can you describe what makes it hard to get healthcare when you need it? **Probe:**
d) How has your experience getting health services affected how you feel/think about healthcare?
e) What do you do when you want to learn more about a health topic or have a question about your health? **Probe:**
   - Where do you go?

- Who do you go to?
- Why do you go there?

2. GENERAL QUESTIONS ABOUT VACCINATION EXPERIENCES AND PERCEPTIONS

Now, I am going to ask you questions about your experiences with vaccination in general.

a) Please describe what you saw or heard about vaccines while growing up. **Probe:**
   - Did you receive vaccines when you were growing up?
   - How did others' opinions affect how you feel/think about vaccines in general?

c) Briefly, can you tell me about your experience getting vaccines throughout your life? **Probe:**
   - What stands out when you think about prior vaccination experiences (As a child vs. as adult? In the US or other countries?)
   - Describe any difficult experiences.

3. QUESTIONS ABOUT COVID-19 IMPACT, INFORMATION SEEKING, CARE SEEKING AND PERCEPTIONS

Now, I am going to ask you about your experiences with COVID-19 and where you get information about it.

a) In a few words, how has COVID-19 and the pandemic affected you and your life? **Probe:**
   - What has changed?

b) You've mentioned that you use **[SOURCES MENTIONED ABOVE IN 1d]** for health information. Are those the sources you've used to get information about COVID-19 too or are there any others? **Probe:**
   - Sources can include: primary care provider, TV, radio, internet/social media, community members (e.g., family, friends, church, other residents), program staff

c) What sources do you trust the most for information about COVID-19? **Probe:**
   - How much do you trust these sources for information on COVID-19 disease?
   - Can you tell me some reasons why you [trust/mistrust] this information?

d) What are your thoughts on COVID-19 policies in Washington State (e.g., public health/government mandates)? **Probe:**
   - Mask requirements /mandates?
   - Vaccine requirements/mandates?
   - FDA approval of boosters?

Now, I am going to ask you about COVID-19 testing.

e) Can you describe your experiences with COVID-19 tests? **Probe:**
   - How do you feel/think about COVID-19 tests?
   - Did you have any issues accessing a COVID-19 test when you wanted one (e.g., transportation or distance to a clinic, you weren't sure where to go to get it)?
   - What would make getting a COVID-19 test easier for yourself? For others?

Now, I am going to ask you about COVID-19 vaccines.

f) What have you heard about COVID-19 vaccines? **Probe:**
   - Can you describe good things you have heard about COVID-19 vaccines?
   - Can you describe concerns you have had related to COVID-19 vaccines?
   - How have your concerns changed over time?
   - What influenced the changes?

g) Where have you found information you trust about COVID-19 vaccines? **Probe:**
   - How much do you trust these sources for information on COVID-19 vaccines?
   - Why?
   - Which do you think are most important/helpful/trustworthy?
   - Which do you think are least important/helpful/trustworthy?
   - What information would [be/have been] helpful to have about COVID-19 vaccines?

h) Where have you found information that you do not trust about COVID-19 vaccines?

i) How do others around you (e.g., friends, family, co-workers) feel/think about COVID-19 vaccines? **Probe:**
   - What have you heard people around you say about COVID-19 vaccination that is positive/negative?

j) What makes it easier for people to get a COVID-19 vaccine?

k) What makes it hard for people to get a COVID-19 vaccine?

l) We are trying to gather questions that people still have about COVID-19 vaccines. If you could know anything about COVID-19 vaccines, what would you want to know? **Probe:**
   - Please explain any unanswered questions that you have.
   - We will not be able to answer these questions today. But we hope these can be included in future shared materials.

4. QUESTIONS ABOUT COVID-19 VACCINATION AND INTENT OVER TIME

a) How do you feel/think about COVID-19 vaccines? **Probe:**
   - **[IF FEELS DIFFERENTLY THAN INDICATED ON PIT]** I noticed in the other survey you stated [], what contributed to this change?

[*AMONG THOSE PLANNING TO GET VACCINATED/ALREADY VACCINATED*]

b) Based on your previous survey, can you tell me more about why you [are planning /chose] to receive a COVID-19 vaccine? **Probe:**
   - Why [do/did] you want to get vaccinated against COVID-19?
   - Describe how you made your decision to get vaccinated.

c) Can you describe your experiences with getting COVID-19 vaccines? **Probe:**
   - What made it easy to get a COVID-19 vaccine?
   - What made it hard to get a COVID-19 vaccine?
   - What would make getting a COVID-19 vaccine easier?
   - Has there been a time where you wanted to receive a COVID-19 vaccine, but had issues accessing it (e.g., transportation or distance to a clinic, you weren't sure where to go to get it)?
   - Did you have any issues with getting your second dose?

d) How have your feelings/thoughts about whether to get a COVID-19 vaccine changed over time? **Probe:**

- **[SHOW PICTURE TO GET FEEDBACK ON VACCINE CONTINUUM[1]]**
    - Can you show me how your feelings/thoughts have changed using this picture?
    - Where do you feel you fit on this picture currently?
    - How is this different from how you felt in the past (if different from right now)?
- **[If changed over time]** Why have you felt more positive or more negative about COVID-19 vaccines?
    - Please tell me more about what or who changed your mind. How?
    - Was there a specific moment where you changed your mind? Please describe.
- **[If no change over time]** Describe why you [are making/made] your decision to get vaccinated.
    - Please tell me more about how you made your decision.

e) How have you changed your opinion on COVID-19 vaccines after hearing others' opinions? **Probe:**

- Tell me specifically who of the people around you (e.g., friends, family, co-workers) have influenced your thoughts on COVID-19 vaccine?
- How did your conversation(s) with them influence/change your attitude towards COVID-19 vaccines?

f) What would help to change people's minds to get the COVID-19 vaccine? **Probe:**

- Describe anything that might change someone's mind...
    - Material items? (e.g., money, sick leave)
    - Mandate? (e.g., requirement for work, travel, healthcare)
    - Information? (e.g., educational event)
    - Personal experience? (e.g., someone close to me is sick/susceptible, outbreak at shelter or shelter nearby)
- What is most important?
- Do you think incentives would improve vaccination?
- What types of incentives might be most effective?
- What types of incentives should not be offered?
- How much money would be appropriate as an incentive for you to be vaccinated?

[*AMONG THOSE UNDECIDED OR NOT INTENDING TO GET VACCINATED*]

b) Can you describe why you have not been vaccinated yet (reasoning, decision-making process)?

c) How have your feelings/thoughts about whether to get a COVID-19 vaccine changed over time? **Probe:**

[1] NOTE: We used a visual vaccine continuum and cue cards during the interviews to help participants recall their vaccine intent or decision-making at different time periods between March 2020 and the date of their interview (through October 2021). This matched time periods specified in the quantitative PIT survey including:

- Spring 2020 (around the start of the pandemic; March-May)
- Winter 2020-2021 (around the holidays; November-February)
- Spring 2021 (when the vaccine became more available; March-May)
- Currently (as of Summer 2021; June-October)

- **[SHOW PICTURE TO GET FEEDBACK ON VACCINE CONTINUUM]**
  - Can you show me how your feelings/thoughts have changed using this picture?
  - Where do you feel you fit on this picture currently?
  - How is this different from how you felt in the past (if different from right now)?
- **[If changed over time]** Why have you felt more positive or more negative about COVID-19 vaccines?
  - Please tell me more about what or who changed your mind. How?
  - Was there a specific moment where you changed your mind? Please describe.
- **[If no change over time]** Describe why you [are making/made] your decision to not get vaccinated.
  - Please tell me more about how you made your decision.

d) How have you changed your opinion on COVID-19 vaccines after hearing others' opinions? **Probe:**
- Tell me specifically who of the people around you (e.g., friends, family, co-workers) have influenced your thoughts on COVID-19 vaccine?
- How did your conversation(s) with them influence/change your attitude towards COVID-19 vaccines?

e) What would you need to change your mind to get the COVID-19 vaccine? **Probe:**
- Describe anything that might change someone's mind...
  - Material items? (e.g., money, sick leave
  - Mandate? (e.g., requirement for work, travel, healthcare)
  - Information? (e.g., educational event)
  - Personal experience? (e.g., someone close to me is sick/susceptible, outbreak at shelter or shelter nearby)
- What is most important?
- Do you think incentives would improve vaccination?
- What types of incentives might be most effective?
- What types of incentives should not be offered?
- Is there a specific amount of money as an incentive that would convince you to be vaccinated? If so, how much?

[AMONG PARTICPANTS WITH CHILD(REN) UNDER THEIR CARE, AS INDICATED IN THE PIT SURVEY]

g) Can you describe your thoughts about vaccinating your child against COVID-19? **Probe:**
- Tell me more about that (e.g., access, availability, eligibility).

5. QUESTIONS ABOUT ORGANIZATIONAL STRATEGY AGAINST COVID-19

Now, I am going to ask you some questions about how this shelter has dealt with COVID-19. Remember, your answers will be anonymous. Your name will not be attached to these answers or shared with anyone outside the research team.

a) I would like to know about how the shelter has communicated with residents **[*AMONG STAFF ONLY*:** and staff. Let's start with residents.] Can you please describe how the shelter communicated with residents about COVID-19 information and rules? **Probe:**
- What worked well?
- What did not work well?

- What would have made it better?
- Please describe any recommendations for how the shelter could better communicate to residents.
- How has this affected you?
- How has the shelter's COVID-19 testing and mask use/social distancing been working or not working?
- (E.g., flyers, information booth)

b) **[*AMONG STAFF ONLY*]** Now I will ask about the shelter's communication with staff. Can you please describe how the shelter communicated with staff about COVID-19 information and rules? **Probe:**
   - What worked well?
   - What did not work well?
   - What would have made it better?
   - Please describe any recommendations for how the shelter could better communicate to staff.
   - How has this affected you?
   - How has the shelter's COVID-19 testing and mask use/social distancing been working or not working?
   - (E.g., flyers, information booth

c) Now we will ask about COVID-19 vaccination. What do you think people's experience here was with getting the COVID-19 vaccine? **Probe:**
   - What has worked?
   - What has not worked?
   - How did it go?
   - What would have made it better?

6. CLOSING STATEMENT

That completes the conversation for today. Do you have any questions, comments, or final thoughts that you would like to share? Thank you again for your participation.

If you have other questions or concerns, you can call our project at [**PHONE NUMBER**]. Before we end the session, I have a few administrative/business details to share with you.

7. ADMINISTRATIVE DETAILS

- **PROVIDE INFORMATION ON GIFT CARDS.**
- **ANY OTHER ADMINISTRATIVE DETAILS**

RECORDER PROTOCOL

- **TEST RECORDER BEFORE THE INTERVIEW AND START RECORDING**

INTERVIEWER PROTOCOL

- **GO THROUGH SCRIPT AND FOLLOW UP WITH QUESTIONS WHEN YOU FIND A NEW THEME OR A NEW INTERESTING PERSPECTIVE:**
  - *"That's interesting, can you tell me more about that?"*
  - *"You mentioned xyz, can you explain a little further about what that means?"*
  - *"Thank you that is very helpful."*

- *“If I’m getting at this right, it sounds like...”*

- **NOTE TAKING**

Appendix A2. Interview Guide – Spanish

Hola. Me llamo_____. Trabajo con el estudio de la gripe de Seattle de la [DEIDENTIFIED]. Hoy queremos hablar con usted para conocer sus pensamientos y experiencias en relación con la asistencia médica. Especialmente, queremos conocer más sobre la vacunación contra la COVID-19. Además, llevaremos a cabo alrededor de 29 entrevistas con otras personas en los refugios del condado de King en Seattle. Valoramos su opinión. Nos ayudará a comprender mejor los sentimientos y las experiencias con la COVID-19, las vacunas y las vacunas contra la COVID-19. También nos ayudará a entender de qué manera las vacunas pueden desempeñar un papel a la hora de mantener su salud y la de su comunidad.

REVISE EL FORMULARIO DE CONSENTIMIENTO POR ESCRITO Y RECIBA EL CONSENTIMIENTO AUDIOVISUAL. AGRADECEMOS A LAS PERSONAS QUE DECIDAN NO PARTICIPAR.

Nuestra conversación de hoy durará entre 30 y 60 minutos aproximadamente. Con su permiso, nos gustaría grabar nuestra conversación de hoy. Intentamos tomar notas, pero no siempre resultan completas. Si quiere hacer un comentario que no quiere que grabemos, dígamelo y apagaré la grabadora. La volveré a encender luego, cuando termine de hacer el comentario. ¿Le parece bien?

Recuerde que todo lo que digamos aquí hoy es confidencial. Lo que comparta conmigo se combinará con la información que aporten otros participantes. De esta manera, nadie sabrá lo que dijo individualmente. ¿Tiene alguna pregunta antes de comenzar?

- INICIA LA GRABADORA VIRTUAL -

[EL ENTREVISTADOR ASIGNA E INDICA EL IDENTIFICADOR ÚNICO AL COMIENZO DE LA GRABACIÓN, POR EJEMPLO, "SSI_OP_TM_2021-06-25"]

Comenzaremos ahora. ¿Puede confirmar que está de acuerdo con que lo grabemos?

1. PREGUNTAS GENERALES SOBRE LAS PERCEPCIONES DEL SISTEMA DE SALUD Y LA OBTENCIÓN DE ASISTENCIA MÉDICA

Comenzaré con preguntas generales sobre sus experiencias en relación con la asistencia médica.

a) ¿Puede decirme a qué lugar acude con mayor frecuencia cuando se enferma o necesita asistencia médica?
b) ¿Puede describir sus experiencias más recientes a la hora de recibir servicios de asistencia médica? **Sondeo:**
    - ¿Han sido experiencias positivas o negativas?
c) **[HAGA REFERENCIA A LAS EXPERIENCIAS NEGATIVAS SI SE MENCIONARON EN 1B]**. ¿Puede describir qué dificulta la obtención de asistencia médica cuando la necesita? **Sondeo:**

- ¿Qué es lo que se interpone?
- ¿Cómo se dirige a la clínica donde recibe asistencia médica? ¿Ha tenido problemas con el traslado hacia una clínica, etc.?
- ¿Qué facilita la obtención de asistencia médica?

d) ¿De qué manera su experiencia con la obtención de servicios de salud ha afectado sus sentimientos o pensamientos sobre la asistencia médica?
e) ¿Qué hace cuando quiere conocer más sobre un tema relacionado con la salud o tiene alguna pregunta sobre su salud? **Sondeo:**
   - ¿A qué lugar acude?
   - ¿A quién acude?
   - ¿Por qué acude a ese lugar?

2. PREGUNTAS GENERALES SOBRE LAS EXPERIENCIAS Y LAS PERCEPCIONES EN RELACIÓN CON LA VACUNACIÓN

A continuación, le haré algunas preguntas sobre sus experiencias con la vacunación en general.

a) Describa lo que vio o escuchó sobre las vacunas durante su niñez. **Sondeo:**
   - ¿Lo vacunaron cuando era niño?
   - ¿De qué manera las opiniones de las demás personas han afectado sus sentimientos o pensamientos sobre las vacunas en general?
b) ¿Puede contarme brevemente acerca de su experiencia con la vacunación a lo largo de su vida? **Sondeo:**
   - ¿Qué destaca cuando piensa en las experiencias de vacunación anteriores (como niño y como adulto; en Estados Unidos o en otros países)?
   - Describa cualquier experiencia difícil.

3. PREGUNTAS SOBRE EL IMPACTO DE LA COVID-19, LA OBTENCIÓN DE INFORMACIÓN, LA OBTENCIÓN DE ASISTENCIA Y LAS PERCEPCIONES

A continuación, le haré algunas preguntas sobre sus experiencias en relación con la COVID-19 y de dónde obtiene información al respecto.

a) En pocas palabras, ¿de qué manera la COVID-19 y la pandemia lo han afectado a usted y a su vida? **Sondeo:**
   - ¿Qué ha cambiado?
b) Usted ha mencionado que utiliza **[FUENTES MENCIONADAS ANTERIORMENTE EN 1d]** cuando desea obtener información relacionada con la salud. ¿Son esas también las fuentes que ha utilizado para obtener información sobre la COVID-19 o recurre a otras? **Sondeo:**
   - Las fuentes pueden incluir las siguientes: proveedor de atención primaria, televisión, radio, internet y redes sociales, miembros de la comunidad (por ejemplo, familia, amigos, miembros de la iglesia y demás residentes), personal del programa.
c) ¿En qué fuentes confía más para obtener información sobre la COVID-19? **Sondeo:**
   - ¿Qué tanto confía en estas fuentes para obtener información sobre la enfermedad por COVID-19?
   - ¿Por qué?

A continuación, le haré algunas preguntas sobre las pruebas de detección de COVID-19.

d) ¿Puede describir sus experiencias en relación con las pruebas de COVID-19? **Sondeo:**
   - ¿Cuál es su forma de sentir o de pensar sobre las pruebas de COVID-19?
   - ¿Tuvo algún problema para acceder a las pruebas de COVID-19 cuando quería someterse a una (por ejemplo, transporte o distancia hasta la clínica; no estaba seguro a dónde acudir para acceder a la prueba)?
   - ¿Qué facilitaría la realización de la prueba de COVID-19 para usted? ¿Y para los demás?

A continuación, le haré algunas preguntas sobre las vacunas contra la COVID-19.

e) ¿Qué ha escuchado sobre las vacunas contra la COVID-19? **Sondeo:**
   - ¿Puede describir los aspectos positivos que ha escuchado sobre las vacunas contra la COVID-19?
   - ¿Puede describir las preocupaciones que ha tenido en relación con las vacunas contra la COVID-19?
   - ¿Cómo han cambiado sus preocupaciones con el tiempo?
   - ¿Qué ha influido en los cambios?

f) ¿Dónde ha encontrado información confiable sobre las vacunas contra la COVID-19? **Sondeo:**
   - ¿Qué tanto confía en estas fuentes para obtener información sobre la enfermedad por COVID-19?
   - ¿Por qué?
   - ¿Cuáles cree que son las más importantes, útiles y fiables?
   - ¿Cuáles cree que son las menos importantes, útiles y fiables?
   - ¿Qué información [le resultaría/le ha resultado] útil sobre las vacunas contra la COVID-19?

g) ¿Dónde ha encontrado información no confiable sobre las vacunas contra la COVID-19?

h) ¿Cuáles son los sentimientos o pensamientos de las demás personas de su entorno sobre las vacunas contra el COVID-19? **Sondeo:**
   - ¿Qué aspectos positivos o negativos ha escuchado de las personas de su entorno sobre la vacunación contra la COVID-19?
   - ¿Cuáles son sus sentimientos o pensamientos sobre las vacunas contra el COVID-19?
   - ¿Cómo ha cambiado su opinión sobre las vacunas contra la COVID-19 luego de escuchar las opiniones de otras personas?

i) ¿Cómo han cambiado sus sentimientos o pensamientos con el tiempo en relación con la posibilidad de vacunarse contra la COVID-19? **Sondeo:**
   - Cuénteme más sobre qué o quién lo ha hecho cambiar de opinión. ¿Cómo?
   - Describa el motivo por el que [está tomando/tomó] su decisión.
   - **[EL ENTREVISTADOR MUESTRA UNA IMAGEN PARA OBTENER COMENTARIOS SOBRE LA CONTINUIDAD DE LA VACUNA]**
   - ¿Puede mostrarme cómo han cambiado sus sentimientos o pensamientos utilizando esta imagen?
   - ¿Dónde cree que está ubicado actualmente en esta imagen?

- ¿En qué se diferencia de la forma en la que se sentía en el pasado (si es distinta de la forma en la que se siente ahora)?

j) Estamos intentando reunir las preguntas que la gente todavía tiene sobre las vacunas contra el COVID-19. Si pudiera saber algo sobre las vacunas contra el COVID-19, ¿qué le gustaría saber? **Sondeo:**

- Describa cualquier pregunta sin respuesta que tenga.
- No podremos responder estas preguntas hoy. Sin embargo, esperamos poder incluirlas en futuros materiales compartidos.

4. PREGUNTAS SOBRE LA VACUNACIÓN CONTRA EL COVID-19 Y LA INTENCIÓN EN EL TIEMPO

[*[ENTRE LAS PERSONAS QUE PLANEAN VACUNARSE O YA ESTÁN VACUNADAS]*]

a) Según su encuesta anterior, ¿puede contarme más acerca de los motivos por los que [está planeando/decidió] vacunarse contra el COVID-19? **Sondeo:**

- ¿Por qué [quiere/quiso] vacunarse contra el COVID-19?
- Describa cómo tomó la decisión de vacunarse.

b) ¿Puede describir sus experiencias a la hora de vacunarse contra el COVID-19?

- ¿Ha habido alguna vez en la que haya querido vacunarse contra el COVID-19, pero haya tenido problemas para hacerlo (por ejemplo, transporte o distancia hasta la clínica; no estaba seguro a dónde acudir para vacunarse)?
- ¿Qué facilitaría la vacunación contra el COVID-19?
- ¿Tuvo algún problema con la colocación de la segunda dosis?

[*[ENTRE LAS PERSONAS QUE ESTÁN INDECISAS O NO TIENEN LA INTENCIÓN DE VACUNARSE]*]

c) ¿Qué necesitaría para cambiar de opinión y vacunarse contra el COVID-19? **Sondeo:**

- Describa lo que podría hacerle cambiar de opinión (por ejemplo, dinero, licencia por enfermedad, requisito en el trabajo, enfermedad/vulnerabilidad de alguien cercano, etc.).
- ¿Qué es lo más importante?

[ENTRE LOS PARTICIPANTES QUE TIENEN NIÑOS A SU CARGO, SEGÚN SE INDICA EN LA ENCUESTA PIT]

d) ¿Puede describir los pensamientos que tiene sobre vacunar a su hijo contra el COVID-19? **Sondeo:**

a. Cuénteme más sobre el tema (por ejemplo, acceso, disponibilidad, elegibilidad).

5. [*[ÚNICAMENTE ENTRE EL PERSONAL*] PREGUNTAS SOBRE LA ESTRATEGIA ORGANIZACIONAL CONTRA EL COVID-19

A continuación, le haré algunas preguntas sobre la manera en la que este refugio ha enfrentado el COVID-19. Recuerde que sus respuestas serán anónimas. Su nombre no se adjuntará a estas respuestas ni se compartirá con alguien ajeno al equipo de trabajo.

a) Me gustaría conocer de qué manera se ha comunicado el refugio con los residentes y el personal. Comencemos con los residentes. ¿Puede describir de qué manera se comunicó el refugio con los residentes en relación con la información y las reglas sobre el COVID-19? **Sondeo:**
    - ¿Qué funcionó bien?
    - ¿Qué no funcionó bien?
    - ¿Qué lo habría mejorado?
    - ¿Cómo lo ha afectado?
    - ¿De qué manera han funcionado o no las pruebas de detección de COVID-19, el uso de mascarillas y la implementación del distanciamiento social en el refugio?
    - (Por ejemplo, folletos, puestos de información).
b) A continuación, haré unas preguntas sobre la comunicación del refugio con el personal. ¿Puede describir de qué manera se comunicó el refugio con el personal en relación con la información y las reglas sobre el COVID-19? **Sondeo:**
    - ¿Qué funcionó bien?
    - ¿Qué no funcionó bien?
    - ¿Qué lo habría mejorado?
    - ¿Cómo lo ha afectado?
    - ¿De qué manera han funcionado o no las pruebas de detección de COVID-19, el uso de mascarillas y la implementación del distanciamiento social en el refugio?
    - (Por ejemplo, folletos, puestos de información).
c) A continuación, haremos algunas preguntas sobre la vacunación contra el COVID-19. ¿Cuál cree que fue la experiencia de las personas aquí a la hora de vacunarse contra el COVID-19? **Sondeo:**
    - ¿Qué ha funcionado?
    - ¿Qué no ha funcionado?
    - ¿Cómo resultó?
    - ¿Qué lo habría mejorado?

6. DECLARACIONES FINALES

Esto completa la conversación por hoy. ¿Tiene alguna pregunta, comentario o reflexión final que le gustaría compartir? Le agradecemos nuevamente su participación.

Si tiene alguna otra pregunta o preocupación, puede comunicarse con nuestro proyecto llamando al [**NÚMERO DE TELÉFONO**]. Antes de terminar la sesión, tengo algunos detalles administrativos/comerciales para compartir con usted.

7. DETALLES ADMINISTRATIVOS

- **PROPORCIONAR INFORMACIÓN SOBRE LAS TARJETAS DE REGALO.**
- **OTROS DETALLES ADMINISTRATIVOS**

PROTOCOLO DE GRABACIÓN

- **PRUEBE LA GRABADORA DE ZOOM ANTES DE LA ENTREVISTA Y COMIENCE A GRABAR**

PROTOCOLO DEL ENTREVISTADOR

- **REPASE EL GUION Y PROFUNDICE CON PREGUNTAS CUANDO ENCUENTRE UN NUEVO TEMA O UNA NUEVA PERSPECTIVA INTERESANTE:**
    - *"¡Qué interesante! ¿Puede contarme más acerca de ello?"*
    - *"Ha mencionado xyz, ¿puede explicar un poco más lo que significa?"*
    - *"Gracias. Es muy útil".*
    - *“Si estoy entendiendo bien, parece que...”*
- **TOMA DE NOTAS**

Appendix A3. Interview Guide – French

Bonjour, je m'appelle _____, je travaille pour l'étude sur la pandémie de [DEIDENTIFIED] à Seattle. Aujourd'hui, nous souhaitons discuter avec vous pour connaître vos réflexions et vos expériences en matière de soins de santé. Plus précisément, nous souhaitons approfondir la question de la vaccination contre le COVID-19. Nous ferons également environ 29 entretiens avec d'autres personnes dans les refuges du comté de King à Seattle. Votre avis est important pour nous. Il nous aidera à mieux comprendre les ressentis et les expériences concernant le COVID-19, les vaccins et les vaccins contre le COVID-19. Il nous aidera également à comprendre comment les vaccins peuvent jouer un rôle dans la protection de votre santé et de celle de votre communauté.

PASSER EN REVUE LE FORMULAIRE DE CONSENTEMENT ÉCRIT ET RECEVOIR UN CONSENTEMENT AUDIO/VISUEL. REMERCIER LES PERSONNES QUI DÉCIDENT DE NE PAS PARTICIPER.

Notre conversation aujourd'hui durera environ 30 à 60 minutes. Avec votre permission, je souhaiterais enregistrer notre conversation d'aujourd'hui. Nous essayons de prendre des notes, mais elles ne sont pas toujours complètes. Si vous souhaitez faire un commentaire que vous ne voulez pas enregistrer, dites-le moi et j'éteindrai le magnétophone. Puis, je le remettrai en marche lorsque vous aurez terminé de faire votre commentaire. C'est d'accord ?

N'oubliez pas que tout ce que nous disons ici aujourd'hui est confidentiel. Ce que vous partagez avec moi sera combiné avec les informations des autres participants. De cette façon, personne ne saura ce que vous avez dit à titre personnel. Avez-vous des questions avant de commencer ?

- DÉMARRER L'ENREGISTREUR VIRTUEL -

[L'INTERVIEWEUR ATTRIBUE ET INDIQUE UN IDENTIFIANT UNIQUE AU DÉBUT DE L'ENREGISTREMENT.PAR EX., "SSI_OP_TM_2021-06-25"]

Nous allons maintenant commencer. Pouvez-vous confirmer que vous acceptez d'être enregistré(e) ?

1. QUESTIONS GÉNÉRALES À PROPOS DE LA PERCEPTION DU SYSTÈME DE SANTÉ ET DE LA RECHERCHE DE SOINS DE SANTÉ

Je vais commencer par des questions d'ordre général sur vos expériences en matière de soins de santé.

a) Pouvez-vous me dire où vous vous rendez le plus souvent lorsque vous êtes malade ou que vous avez besoin de soins de santé ?
b) Pouvez-vous décrire vos expériences les plus récentes en matière de services de soins de santé ? **Approfondir :**

- Ces expériences étaient-elles positives ou négatives ?

c) **[SE REPORTER AUX EXPÉRIENCES NÉGATIVES SI MENTIONNÉES AU 1B]**. Pouvez-vous nous expliquer ce qui rend difficile l'accès aux soins de santé lorsque vous en avez besoin ? **Approfondir :**
d) De quelle manière votre expérience des services de santé a-t-elle influé sur votre perception des soins de santé ?
e) Que faites-vous lorsque vous souhaitez en savoir plus sur un sujet de santé ou que vous avez une question au sujet de votre santé ? **Approfondir :**
    - Où allez-vous ?
    - Chez qui allez-vous ?
    - Pourquoi y allez-vous ?

2. QUESTIONS GÉNÉRALES À PROPOS DES EXPÉRIENCES EN MATIÈRE DE VACCINATION ET DES PERCEPTIONS

À présent, je vais vous poser des questions sur vos expériences en matière de vaccination en général.

a) Veuillez décrire ce que vous avez vu ou entendu au sujet des vaccins dans votre enfance. **Approfondir :**
    - Avez-vous reçu des vaccins lorsque vous étiez enfant ?
    - Comment les opinions des autres ont-elles influencé vos sentiments et vos opinions sur les vaccins en général ?
b) Pouvez-vous me raconter brièvement votre expérience en matière de vaccins au cours de votre vie ? **Approfondir :**
    - Qu'est-ce qui se distingue lorsque vous pensez à vos précédentes expériences de vaccination (en tant qu'enfant versus en tant qu'adulte ? Aux États-Unis ou dans d'autres pays ?)
    - Décrivez les expériences difficiles.

3. QUESTIONS À PROPOS DE L'IMPACT DU COVID-19, DE LA RECHERCHE D'INFORMATIONS, DE LA RECHERCHE DE SOINS ET DES PERCEPTIONS

Maintenant, je vais vous poser des questions à propos de vos expériences avec le COVID-19 et où vous obtenez des informations à ce sujet.

a) En quelques mots, quelles conséquences le COVID-19 et la pandémie ont-elles eues sur vous et sur votre vie ? **Approfondir :**
    - Qu'est-ce qui a changé ?
b) Vous avez mentionné que vous utilisez **[SOURCES MENTIONNÉES CI-DESSUS DANS 1d]** pour obtenir des informations sur la santé. Avez-vous également utilisé ces sources pour obtenir des informations sur le COVID-19 ou y en existe-t-il d'autres ? **Approfondir :**
    - Les sources peuvent comprendre : le fournisseur de soins primaires, la télévision, la radio, l'Internet/médias sociaux, les membres de la communauté (par ex., famille, amis, église, autres résidents), le personnel du programme
c) Quelles sont les sources auxquelles vous faites le plus confiance pour obtenir des informations sur le COVID-19 ? **Approfondir :**
    - Dans quelle mesure faites-vous confiance à ces sources pour obtenir des informations sur la maladie COVID-19 ?

- Pouvez-vous me donner quelques-unes des raisons pour lesquelles vous faites [confiance/méfiance] à ces informations ?

d) Que pensez-vous des politiques relatives au COVID-19 dans l'État de Washington (par ex., les mandats de santé publique et du gouvernement) ? **Approfondir :**
   - Les exigences /prescriptions du masque ?
   - Les exigences /prescriptions du vaccin ?
   - L'approbation des doses de rappel par la FDA ?

Maintenant, je vais vous poser des questions sur les tests de dépistage du COVID-19.

e) Pouvez-vous décrire vos expériences avec les tests de dépistage du COVID-19 ? **Approfondir :**
   - Que pensez-vous des tests de dépistage du COVID-19 ?
   - Avez-vous rencontré des difficultés pour accéder à un test de dépistage du COVID-19 lorsque vous le souhaitiez (par ex., transport ou distance jusqu'à une clinique, vous ne saviez pas où aller pour le faire) ?
   - Qu'est-ce qui vous aiderait à faire un test de dépistage du COVID-19 plus facilement ? Pour les autres ?

Maintenant, je vais vous poser des questions sur les vaccins contre le COVID-19.

f) Qu'avez-vous entendu au sujet des vaccins contre le COVID-19 ? **Approfondir :**
   - Pouvez-vous décrire les bonnes choses que vous avez entendues au sujet des vaccins contre le COVID-19 ?
   - Pouvez-vous décrire les inquiétudes que vous avez eues concernant les vaccins contre le COVID-19 ?
   - Comment vos préoccupations ont-elles évolué au fil du temps ?
   - Qu'est-ce qui a influencé cette évolution ?

g) Où avez-vous trouvé des informations en lesquelles vous avez confiance concernant les vaccins contre le COVID-19 ? **Approfondir :**
   - Quel degré de confiance accordez-vous à ces sources d'information sur les vaccins contre le COVID-19 ?
   - Pourquoi ?
   - Lesquelles sont, selon vous, les plus importantes/utiles/dignes de confiance ?
   - Lesquelles sont, selon vous, les moins importantes/utiles/dignes de confiance ?
   - Quelles informations [seraient/ont été] utiles au sujet des vaccins contre le COVID-19 ?

h) Où avez-vous trouvé des informations en lesquelles vous n'avez pas confiance concernant les vaccins contre le COVID-19 ?

i) Comment les autres personnes autour de vous (par ex., vos amis, votre famille, vos collègues de travail) se sentent-elles/pensent-elles à propos des vaccins contre le COVID-19 ? **Approfondir :**
   - Qu'avez-vous entendu des personnes autour de vous dire de positif/négatif à propos de la vaccination contre le COVID-19 ?

j) Qu'est-ce qui facilite l'accès des personnes au vaccin contre le COVID-19 ?

k) Qu'est-ce qui complique l'accès des personnes au vaccin contre le COVID-19 ?

l) Nous essayons de rassembler les questions que les personnes se posent encore au sujet des vaccins contre le COVID-19. Si vous pouviez savoir quelque chose sur les vaccins contre le COVID-19, que voudriez-vous savoir ? **Approfondir :**
   - Veuillez expliquer les questions que vous vous posez et qui sont restées sans réponse.
   - Nous ne pourrons pas répondre à ces questions aujourd'hui. Mais nous espérons pouvoir les inclure dans les futurs documents partagés.

4. QUESTIONS À PROPOS DE LA VACCINATION CONTRE LE COVID-19 ET DE L'ÉVOLUTION DE L'INTENTION

a) Que pensez-vous des vaccins contre le COVID-19 ? **Approfondir :**
   - **[SI L'IMPRESSION EST DIFFÉRENTE DE CELLE INDIQUÉE DANS LE CADRE]** J'ai remarqué que dans l'autre enquête, vous avez déclaré [], qu'est-ce qui a contribué à ce changement ?

[*PARMI LES PERSONNES PRÉVOYANT DE SE FAIRE VACCINER/DÉJÀ VACCINÉES*]

b) Sur la base de votre précédente enquête, pouvez-vous m'en dire plus sur les raisons pour lesquelles vous [envisagez/choisissez] de vous faire vacciner contre le COVID-19 ? **Approfondir :**
   - Pourquoi [vous êtes-vous fait(e)/souhaitez-vous vous faire] vacciner contre le COVID-19 ?
   - Décrivez comment vous avez pris la décision de vous faire vacciner.

c) Pouvez-vous décrire vos expériences concernant l'obtention des vaccins contre le COVID-19 ? **Approfondir :**
   - Qu'est-ce qui a facilité la vaccination contre le COVID-19 ?
   - Qu'est-ce qui a compliqué la vaccination contre le COVID-19 ?
   - Qu'est-ce qui vous aiderait à vous faire vacciner contre le COVID-19 plus facilement ?
   - Y a-t-il eu un moment où vous avez voulu vous faire vacciner contre le COVID-19, mais où vous avez eu des difficultés à le faire (par ex., transport ou distance jusqu'à une clinique, vous ne saviez pas où aller pour le faire) ?
   - Avez-vous eu des problèmes pour faire la deuxième dose ?

d) Comment vos opinions/réflexions sur le fait de vous faire vacciner contre le COVID-19 ont-elles évolué au fil du temps ? **Approfondir :**
   - **[MONTRER L'IMAGE POUR OBTENIR DES COMMENTAIRES SUR LE CONTINUUM DE VACCINATION]**
     - Pouvez-vous me montrer comment vos opinions/réflexions ont changé en utilisant cette image ?
     - Où vous percevez-vous actuellement sur cette image ?
     - En quoi est-ce différent de ce que vous avez ressenti par le passé (si c'est différent du présent) ?
   - **[Si vous avez changé d'avis au fil du temps]** Pourquoi vous êtes-vous senti(e) plus favorable ou plus défavorable aux vaccins contre le COVID-19 ?
     - Veuillez m'en dire plus sur ce qui ou sur qui vous a fait changer d'avis. Comment ?
     - Y a-t-il eu un moment précis où vous avez changé d'avis ? Veuillez donner des détails.

- **[En l'absence de changement au fil du temps]** Décrivez les raisons pour lesquelles vous [prenez/avez pris] la décision de vous faire vacciner.
    - Veuillez m'en dire plus sur la façon dont vous avez pris votre décision.

e) Comment avez-vous changé d'avis sur les vaccins contre le COVID-19 après avoir entendu les opinions des autres ? **Approfondir :**

- Dites-moi plus particulièrement qui parmi les personnes de votre entourage (par ex., amis, famille, collègues de travail) a influencé votre opinion sur le vaccin contre le COVID-19 ?
- Comment votre ou vos conversations avec ces personnes ont-elles influencé/changé votre attitude vis-à-vis des vaccins contre le COVID-19 ?

f) Qu'est-ce qui pourrait aider à faire changer d'avis les personnes pour qu'elles se fassent vacciner contre le COVID-19 ? **Approfondir :**

- Décrivez tout ce qui pourrait faire changer d'avis quelqu'un...
    - Éléments matériels ? (par ex., argent, congé maladie)
    - Obligation ? (par ex., obligation pour le travail, les voyages, les soins de santé)
    - Informations ? (par ex., activité éducative)
    - Expérience personnelle ? (par ex., un proche est malade ou susceptible de l'être, épidémie au refuge ou dans un refuge proche)
- Qu'est-ce qui est le plus important ?
- Pensez-vous que des mesures incitatives amélioreraient la vaccination ?
- Quels types de mesures incitatives pourraient être les plus efficaces ?
- Quels types de mesures incitatives ne devraient pas être offerts ?
- Quelle somme d'argent serait adéquate pour vous inciter à vous faire vacciner ?

[*PARMI LES PERSONNES INDÉCISES OU CELLES QUI N'ONT PAS L'INTENTION DE SE FAIRE VACCINER*]

f) Pouvez-vous décrire pourquoi vous n'avez pas encore été vacciné(e) (raisonnement, processus de décision) ?

g) Comment vos opinions/réflexions sur le fait de vous faire vacciner contre le COVID-19 ont-elles évolué au fil du temps ? **Approfondir :**

- **[MONTRER L'IMAGE POUR OBTENIR DES COMMENTAIRES SUR LE CONTINUUM DE VACCINATION]**
    - Pouvez-vous me montrer comment vos opinions/réflexions ont changé en utilisant cette image ?
    - Où vous percevez-vous actuellement sur cette image ?
    - En quoi est-ce différent de ce que vous avez ressenti par le passé (si c'est différent du présent) ?
- **[Si vous avez changé d'avis au fil du temps]** Pourquoi vous êtes-vous senti(e) plus favorable ou plus défavorable aux vaccins contre le COVID-19 ?
    - Veuillez m'en dire plus sur ce qui ou sur qui vous a fait changer d'avis. Comment ?
    - Y a-t-il eu un moment précis où vous avez changé d'avis ? Veuillez donner des détails.
- **[En l'absence de changement au fil du temps]** Décrivez les raisons pour lesquelles vous [prenez/avez pris] la décision de ne pas vous faire vacciner.
    - Veuillez m'en dire plus sur la façon dont vous avez pris votre décision.

h) Comment avez-vous changé d'avis sur les vaccins contre le COVID-19 après avoir entendu les opinions des autres ? **Approfondir :**
    - Dites-moi plus particulièrement qui parmi les personnes de votre entourage (par ex., amis, famille, collègues de travail) a influencé votre opinion sur le vaccin contre le COVID-19 ?
    - Comment votre ou vos conversations avec ces personnes ont-elles influencé/changé votre attitude vis-à-vis des vaccins contre le COVID-19 ?

i) Que faudrait-il pour que vous changiez d'avis et acceptiez de vous faire vacciner contre le COVID-19 ? **Approfondir :**
    - Décrivez tout ce qui pourrait faire changer d'avis quelqu'un...
        - Éléments matériels ? (par ex., argent, congé maladie
        - Obligation ? (par ex., obligation pour le travail, les voyages, les soins de santé)
        - Informations ? (par ex., activité éducative)
        - Expérience personnelle ? (par ex., un proche est malade ou susceptible de l'être, épidémie au refuge ou dans un refuge proche)
    - Qu'est-ce qui est le plus important ?
    - Pensez-vous que des mesures incitatives amélioreraient la vaccination ?
    - Quels types de mesures incitatives pourraient être les plus efficaces ?
    - Quels types de mesures incitatives ne devraient pas être offerts ?
    - Existe-t-il une somme d'argent précise à titre de mesure incitative qui vous convaincrait de vous faire vacciner ? Si oui, quel montant ?

[PARMI LES PARTICIPANTS AYANT UN OU PLUSIEURS ENFANTS À LEUR CHARGE, COMME INDIQUÉ DANS LE CADRE DE L'ENQUÊTE]

h) Pouvez-vous nous décrire ce que vous pensez de la vaccination de votre enfant contre le COVID-19 ? **Approfondir :**
    - Dites-m'en plus à ce sujet (par ex., l'accès, la disponibilité, l'admissibilité).

5. QUESTIONS À PROPOS DE LA STRATÉGIE ORGANISATIONNELLE CONTRE LE COVID-19

À présent, je vais vous poser quelques questions concernant la façon dont ce refuge a géré le COVID-19. N'oubliez pas que vos réponses seront traitées de manière anonyme. Votre nom ne figurera pas dans ces réponses et ne sera pas communiqué à des personnes extérieures à l'équipe de recherche.

a) Je souhaiterais savoir comment le refuge a communiqué avec les résidents **[*PARMI LES MEMBRES DU PERSONNEL SEULEMENT* :** et le personnel. Commençons par les résidents.] Pouvez-vous décrire la façon dont le refuge a communiqué aux résidents les informations et les règles relatives au COVID-19 ? **Approfondir :**
    - Qu'est-ce qui a bien fonctionné ?
    - Qu'est-ce qui n'a pas bien fonctionné ?
    - Qu'est-ce qui aurait pu l'améliorer ?
    - Veuillez décrire les recommandations concernant la façon dont le refuge pourrait mieux communiquer les informations aux résidents.
    - Comment cela vous a-t-il touché ?

- Comment la politique de tests de dépistage du COVID-19 et d'utilisation de masques/la distanciation physique du refuge a-t-elle fonctionné ou pas fonctionné ?
- (Par ex., dépliants, stand d'information)

b) **[*PARMI LES MEMBRES DU PERSONNEL SEULEMENT*]** Maintenant, je vais poser des questions sur la communication du refuge avec le personnel. Pouvez-vous décrire la façon dont le refuge a communiqué au personnel les informations et les règles relatives au COVID-19 ? **Approfondir :**
   - Qu'est-ce qui a bien fonctionné ?
   - Qu'est-ce qui n'a pas bien fonctionné ?
   - Qu'est-ce qui aurait pu l'améliorer ?
   - Veuillez décrire les recommandations concernant la façon dont le refuge pourrait mieux communiquer les informations au personnel.
   - Comment cela vous a-t-il touché ?
   - Comment la politique de tests de dépistage du COVID-19 et d'utilisation de masques/la distanciation physique du refuge a-t-elle fonctionné ou pas fonctionné ?
   - (Par ex., dépliants, stand d'information

c) À présent, nous allons vous poser des questions sur la vaccination contre le COVID-19. Que pensez-vous de l'expérience des personnes ici qui se sont faites vacciner contre le COVID-19 ? **Approfondir :**
   - Qu'est-ce qui a fonctionné ?
   - Qu'est-ce qui n'a pas fonctionné ?
   - Comment cela s'est passé ?
   - Qu'est-ce qui aurait pu l'améliorer ?

6. ÉNONCÉ FINAL

Cela termine la conversation d'aujourd'hui. Avez-vous des questions, des commentaires ou des réflexions finales que vous souhaiteriez partager ? Merci encore de votre participation.

Si vous avez d'autres questions ou préoccupations, vous pouvez appeler notre responsable du projet au [**NUMÉRO DE TÉLÉPHONE**]. Avant de terminer la session, il reste quelques détails administratifs/professionnels que je dois partager avec vous.

7. DÉTAILS ADMINISTRATIFS

- **FOURNIR DES INFORMATIONS SUR LES CARTES-CADEAUX.**
- **TOUS LES AUTRES DÉTAILS ADMINISTRATIFS**

PROTOCOLE POUR L'ENREGISTREUR

- **TESTER L'ENREGISTREUR AVANT L'ENTRETIEN ET COMMENCER L'ENREGISTREMENT**

PROTOCOLE DE L'INTERVIEWEUR

- **PARCOUREZ LE SCRIPT ET POURSUIVEZ AVEC LES QUESTIONS LORSQUE VOUS TROUVEZ UN NOUVEAU THÈME OU UNE NOUVELLE PERSPECTIVE INTÉRESSANTE :**

- *« C’est intéressant, vous pouvez m’en dire plus à ce sujet ? »*
- *« Vous avez mentionné xyz, pouvez-vous expliquer un peu plus en détail ce que cela signifie ? »*
- *« Merci, c’est très utile. »*
- *« Si je comprends bien, on dirait que... »*

- **PRISE DE NOTES**

Appendix A4. Interview Guide – Amharic

ሄሎ፣ስሜ------ነው፤ከዋሽንግተን ዩንቨርስት የሲያትል ፍሉ ምርምር ([DEIDENTIFIED] Seattle Flu Study) ጋር ነው የሚሰራው፡፡ ዛሬ ከሀልዝ ኬር ጋራ ስላለዎት ምልድ እና አመለካከት ለማወቅ ከእርስዎ ጋር ለማውራት ፈለግን፡፡ በተለይም ስለኮቪድ-19 ክትባት የበለጠ ማወቅ እንፈልጋለን፡፡ እንዲሁም በሲያትል King ካውንቲ መጠለያ ውስጥ ከሌሎች ወደ 29 ከሚሆኑ ሰዎች ጋር ምቃ ለመጠይቅ እናደርጋለን፡፡ አሰተያየትዎን እናከብራለን፡፡ ይህም ስለኮቪድ-19፣ ስለክትባት እና ስለኮቪድ-19 ክትባት ያለዎትን አመለካከቶች እና ልምዶችን በተሻለ ሁኔታ ለማወቅ ይረዳናል፡፡ እንዲሁም ክትባት እርስዎን እና ማህበረሰብዎን በጤንነት ለመጠበቅ እንዴት ሊጫወት የሚችለውን ሚና ለመረዳት ያግዘናል፡፡

የፅሁፍ ስምምነት ቅፁን ይመለከቱና የድምፅ/የምስል ስምምነት ይቀበሉ፡፡ ላለመሳተፍ የፈለገውን ማንኛውንም ሰው ያመስግኑት፡፡

ውይይታችን ዛሬ ወደ ከ30-60 ደቂቃዎችን የሚወስድ ይሆናል፡፡ በፍቃድዎ፣ የዛሬ ውይይታችንን ለመቅዳ ትእፈልጋለሁ፡፡ ማስታወሻ ለመያዝ እንሞክራለን ነገርግን፤ ሁልጊዜ ሙሉ አይሆኑም፡፡ እንዳይቀረፅ የማትፈልጉት አሰተያየት ካለ፡ይንገሩኝና መቀዳቱን ለማቆም እችላለሁኝ፡፡ ከዚያ በኋላ አስተያየትዎን እንደጨረሱ መቅዳ ትእንድ ጀምር አደርጋለሁኝ፡፡ ይህ ይሆናል?

እባክዎን ያሰታውስ፣ማንኛውም ዛሬ እዚህ የሚንነጋገርበት ጉዳይ በሙሉ ሚስጥርነቱ የተጠበቀ ነው፡፡ እርስዎ የሚነግሩኝን መረጃ ከሌሎች ተሳታፊዎች አስተያየት ጋር ይቀላቀላል፡፡ በዚህም ምክንያት እንደ ግለሰብ እርስዎ ምን እንዳሉ የሚለይበት ምንም መንገድ የለም፡፡ ከመጀመራችን በፊት ጥያቄ አልዎት?

-ምስለ-ድምፅ መቀረጃውን ያስጀመሩት-

[ቃለመጠይ አድራጊው በመቅጃው መጀመሪያ ላይ የተለየ መለያ ይሰጣል፣ ለምሳሌ፤ "SSI_OP_TM_2021-06-25"]

አሁን እንጀምራለን፡፡ ድምፅ እንዲቀዳ ፈቃደኛ መሆንዎን ሊያረጋግጡልኝ ይችላሉ?

1. አጠቃላይ ስለጤና ስርዓት ቅድመ ማስጠንቀቂያዎች እና የጤና እንክብካቤን መፈለግን በተመለከተ

ስለጤና እንክብካቤን ባለዎት ልምድ አጠቃላይ ጥያቄዎች ሊጀምር ነው፡፡

a) በአብዛኛው ስታመሙ ወይም የጤና እክብካቤ በሚፈልጉበት ወቅት ወዴት እንደሚሄዱ ሊነግሩኝ ይችላሉ?
b) የጤና እንክብካቤ አገልግሎቶችን ለማግኘት በጣም የቅርብ ጊዜ ልምድዎን ሊገልፁልን ይችላሉ? **ያበረታቱ:**
    - አሉታዊ ወይንስ አውንታዊ ተሞክሮ ነበር?
c) **[ከተጠቀሰ አሉታዊው ተሞክሮዎችን ካሉ ያንሱ 1B]**. በሚፈልጉበት ወቅት የጤና እንክብካቤን እንዳያገኙ የሚያዳግተዎን ነገር መግለፅ ይችላሉ? **ያበረታቱ:**
    - በሂደቱ ምን ገጠመዎት?
    - የጤና እንክብካቤ ወደ ሚያገኙበት ክሊኪክ እንዴት ነው የሚደርሱት? ወደ ክሊንክ /ወዘተ ለመሄድ የትራንስፖርት ችግር አለብዎ?
    - ወደ ጤና እንክብካቤ ለመድረስ ቀላል ሊያደርግ የሚችል ምንድነው?
d) የጤና አግልግሎችን የማግኘት ልምድዎ እንዴት ስለጤና እንክብካቤያለዎትንስሜት/አስተሳሰብላይተፅዕኖአደረገ?
e) ስለጤናርዕሰጉዳዮችየበለጠለማወቅበሚፈልጉበትወቅትወይምስለየጤናዎጥያቄቢኖርዎምንያደርጋሉ? **ያበረታቱ:**
    - የትነው የሚትሄዱት?
    - ወደ ማን ይሄዳሉ?
    - ለምን ወደዚያ ይሄዳሉ?

2. አጠቃላይ ስለክትባት ተሞክሮዎች እና አመለካከቶች

አሁን፣ስለክትባትስ ላልዎት አጠቃላይ ተሞክሮዎችን አስመልክቶ ጥያቄ ሊጠይቅዎ ነው፡፡

a) እባክዎን በሚያድጉበት ወቅት ስለክትባት የሰሙት ወይም ያዩትን ነገሮች ይግለፁልን፡፡ **ያበረታቱ:**
   - በህፃንነትዎ ክትባት አግኝተዋልን?
   - የሌሎች ሰዎች አስተያየት በአጠቃላይ ስለክትባት ስላልዎት አመለካከት/አስተሳሰብ ላይ እንዴት ተፅዕኖ አሳደረ?

b) በአጭሩ፣በህይወት ዘመንዎ ስለክትባት መውሰድ ያለዎትን ተሞክሮዎች ሊነግሩን ይችላሉ? **ያበረታቱ:**
   - ስለቀድሞ የክትባት ተሞክሮዎች በሚያስቡበት ወቅት በጣም የማይረሱት ምንድነው (እንደ ህፃን እና እንደ አዋቂ)? በዩኤስ ወይም በሌሎች ሀገራት?)
   - የትኛውንም ለየት ያለ ተሞክሮ ይግለፁ፡፡

3. ስለኮቪደ-19 ተፅዕኖ፣ መረጃን ስለመፈለግ፣እንክብካቤን ስለመፈለግ እና ቅበላን ስለተመለከቱ ጥያቄዎች

አሁን ስለኮቪድ-19 ያለዎትን ተሞክሮ እና ስለእሱ መረጃ ከየት እንደሚያገኙ ጥያቄ ሊጠይቅዎ ነው፡፡

a) በጥቂት ቃላቶች፣ ኮቪድ-19 እንዴት እንደ ነበረ እና ወረርሽኙ እንዴት የእርስዎን እና የቤተሰብዎን ህይወት እንደነካ ይንገሩኝ? **ያበረታቱ:**
   - ምንድነው የተቀየረ?

b) ለጤና መረጃነት **[ከላይ የተጠቀሱ ምንጮች መካከል 1d]**እንደሚጠቀሙ ጠቅሰው ነበር፡፡ እነዚህን ምንጮችን ለኮቪድ-19ን መረጃን ለማግኘት የሚጠቀሙት ነው ወይስ ሌሎች አሉ? **ያበረታቱ:**
   - ምንጮቹ ሊያካትቱ የሚችሉት፡ የመጀመሪያ እክብካቤ አቅራቢ፣ ቲቪ፣ ራዲዮ፣እንተርኔት/ማህበራዊ ሚዲያ፣ የማህበረሰብ አባላቶች (ለምሳሌ፣ቤተሰብ፣ ጓደኞች፣ ቤተክርስትያን፣ ሌሎች ነዋሪዎች)፣የፕሮግራም ሰራተኞች

c) ለኮቪድ-19 መረጃ የበለጠ የሚያምኑት ምንጭ የትኛው ነው? **ያበረታቱ:**
   - ስለኮቪድ-19 በሽታ መረጃ እነዚህን ምንጮች ምን ያህል ያመናሉ?
   - ለምን?

አሁን፣ ስለኮቪድ-19 ምርመራ ሊጠይቅዎ ነው፡፡

d) በኮቪድ-19 ምርመራ ያለዎትን ተሞክሮ ሊገልፁልን ይችላሉ? **ያበረታቱ:**
   - ስለኮቪድ-19 ምርመራዎች እንዴት ያስባሉ/ይሰማዎታል?
   - የኮቪድ-19 ምርመራን ፈልገው ለማግኘት የተቸገሩበት ሁኔታዎች መካከል አንድ ካለ (ለምሳሌ፣ትራንሰፖርት ወይም ከክለኒኩ ያለ ርቀት፣ ለማግኘት ወዴት መሄድ እንዳለብዎ እርግጠኛ አልነበሩም)?
   - የኮቪድ-19ን ምርመራን ለራስዎ ለመግኘት ቀላል ሊያደርግልዎ የሚችል ምንድነው? ለሌሎችስ?

አሁን፣ስለኮቪድ-19 ክትባቶች ጥያቄ ልጠይቅዎ ነው፡፡

e) ስለኮቪድ-19 ክትባቶች የሰሙት ምንድነው? **ያበረታቱ:**
   - ስለኮቪድ-19 ክትባቶች የሰሙት መልካም ነገር ካለ ቢገልፁልን?
   - ከኮቪድ-19 ክትባቶች ጋር ተያይዞ ያለዎትን ፍርሃቶችን ሊገልፁ ይችላሉ?
   - ፍርሃትዎ በግዜ ሂደት እንዴት ተለወጠ?
   - ለውጦቹ ላይ ተፅዕኖ ያደረገው ምንድነው?

f) ስለኮቪድ-19 ክትባቶች የሚያምኑትን መረጃ ከወዴት ከየት ነው የሚያገኙት? **ያበረታቱ:**
   - ስለኮቪድ-19 በሽታ መረጃ እነዚህን ምንጮች ምን ያህል ያመናሉ?
   - ለምን?
   - የትኞቹ የበለጠ አስፈላጊ/ ጠቃሚ/ ታማኝ ናቸው ብለው ያስባሉ?
   - የትኞቹ ያነሰ አስፈላጊ/ ጠቃሚ/ ታማኝ ናቸው ብለው ያስባሉ?
   - ስለኮቪድ -19 ክትባቶች የትኞቹን መረጃዎች ጠቃሚ [ናቸው/ ይሆናሉ] ብለው ያስባሉ?

g) ስለኮቪድ-19 ክትባቶች የማያምኑትን መረጃ ከየት ነው የሚያገኙት?

h) በዙሪያዎ የሚገኙት ሌሎች ሰዎች ስለኮቪድ-19 ክትባቶች ምን ያስባሉ/ ይሰማቸዋ? **ያበረታቱ:**

- በዙሪያዎ የሚገኙት ሌሎች ሰዎች ስለኮቪድ-19 ክትባቶች አሉታዊ/ አዎንታዊ ነገር ምን ሲሉ ሰምተው ያውቃሉ?
- ስለኮቪድ-19 ክትባቶች ምን ይሰማዎታል/ያስባሉ?
- ስለኮቪድ-19 ክትባቶች የሌሎችን አስተያየት ከሰሙ በኋላ ያለዎችን አስተያየት ምን ያህል ለወጠው?

i) በጊዜ ሂደት የኮቪድ-19 ክትባትን መከተብ ስሜትዎ/ አመለካከትዎ ምን ያህል ተለወጠ? **ያበረታቱ:**
- እባክዎን አመለካከትዎን ምን ወይም ማን እንደ ቀየረው የበለጠ ይንገሩኝ፡፡ እንዴት?
- ለምን ውሳኔውን [እንደ ሚያደርጉ/ እንዳደረጉ] ይግለፁ፡፡
- **[ግብረ መልስ ለማግኘት የክትባቱን ቀጣይነትን (VACCINE CONTINUUM) ስዕል ያሳዩ]**
- ይህንን ስዕል በመጠቀም ምን ያህል ስሜትዎ/ አስተሳሰብዎ እንደ ተለወጠ ሊነግሩኝ ይችላሉ?
- በአሁኑ ሰዓት በስዕሉ ላይ የትኛው ላይ እንዳሉ ሰማዎታል?
- ይህ በፊት ከሚሰማዎት እንዴት ይለያል (ከአሁኑ የሚለይ ከሆነ)?

j) ሰዎች ስለኮቪድ-19 ክትባት ስላላቸው መረጃ እያሰባሰብን ነው፡፡ ስለኮቪድ-19 ክትባቶች ማወቅ ቢኖርብዎ፣ማወቅ የሚፈልጉት ምንድነው? **ያበረታቱ:**
- እባክዎን ማንኛውንም ያልተመለሱ ጥያቄዎች ካለዎት ይንገሩን፡፡
- እነዚህን ጥያቄዎች አሁን ልንመልስ አንችልም፡፡ ነገርግን ወደፊት በሚሰራጩ ፅሁፎች ውስጥ እንደሚካተቱ ተስፋ እናደርጋለን፡፡

4. ስለኮቪድ-19 ክትባቶች ጥያቄዎች እና ከጊዜ በኋላ ያለ አስተሳሰብ

[*ክትባትን ለመውሰድ ካቀዱ/ በወሰዱት መካከል*]

a) በበፊቱ ምልከታ ላይ ተመስርተው፣ ለምን የኮቪድ-19 ክትባትን ለመከተብ [እንደ አቀዱ/መረጡ] የበለጠ ልነግሩኝ ይችላሉ? **ያበረታቱ:**
- ለኮቪድ-19 ለምን [ተከተቡ/ለመከተብ] ፈለጉ?
- ለመከተብ እንዴት እንደ ወሰኑ ይንገሩኝ፡፡

b) የኮቪድ-19 ክትባትን ለመከተብ በያጋጠመዎት ተሞክሮዎች ሊነግሩኝ ይችላሉ?
- የኮቪድ-19 ክትባትን ለመከተብ ፈልገው ነገርግን ለማግኘት ችግር ያጋጠመዎት ጊዜ ነበር (ለምሳሌ፣ትራንስፖርት ወይም ከክሊኒኩ ያለው ርቀት፣ የት እንደሚገኝ እርግጠኛ ያለመሆን)?
- የኮቪድ-19 ክትባትን ለማግኘት ቀላል ሊያደርጉ የሚያስችሉ ነገሮች ምንድናቸው?
- ሁለተኛውን ክትባት ለማግኘት ያገጠዎት ችግር ነበርን?

[*ክትባት ለመውሰድ ካልወሰኑ ወይም ካላሰቡት መካከል*]

c) የኮቪድ-19 ክትባትን ለመከተብ ምን አእምሮዎን የሚለውጥ ይመስልዎታል? **ያበረታቱ:**
- አእምሮዎን ሊለውጥ የሚችል የትኛውንም ነገር ይግለፁ (ለምሳሌ፣ገንዘብ፣ የህመም እረፍት፣ በስራ የሚፈለግ መስፈርት፣የቅርብ ሰው መታመም/መጠርጠር፣ ወዘተ)
- በጣም አስፈላጊው የቱ ነው?

[በጥናት ጥናት እንደ ተጠቀሰ፣በእንክብካቤያቸው ስር ካሉ ህፃናት(ቶች) የሚሳተፉት መካከል]

d) ህ ፃናትን ለኮቪድ-19 ስለማስከተብ ያለዎትን አስተሳሰብ ሊያብራሩ ይችላሉን? **ያበረታቱ:**
   b. ስለእሱ የበለጠ ይንገሩኝ (ለምሳሌ፣ ተደራሽነት፣ መገኘት፣መስፈርት ማሟላት)፡፡

5. [*በሰራተኛ መካከል ብቻ*] ኮቪድ-19ን ለመከላከል ስለተቋማዊ ስልት የተመለከቱ ጥያቄዎች

አሁን ይህ መጠለያ እንዴት ኮቪድ-19ን መከላከል እንደ ሰራ ጥቂት ጥያቄዎችን እጠይቅዎታለሁኝ፡፡ ያስታውሱ በመልስዎ ማንነትዎ አይታወቅም፡፡ በእነዚህ መልሶች ላይ ስምዎ አይያያዝም ወይም ከዚህ የጥናት ቡድን ውጭ ከማንም ጋር የሚካፈል አይደለም፡፡

a) መጠለያው ከሌሎቹ ነዋሪዎች ጋር እንዴት እንተነጋገረ ለማወቅ እፈልጋለሁ፡፡ እስቲ በነዋሪዎች እንጀምር፡፡ እባክዎን መጠለያው ከሌሎቹ ነዋሪዎች ጋር እንዴት ስለኮቪድ-19 መረጃና ደንቦች እንተነጋገረ ሊነግሩን ይችላሉ? **ያበረታቱ:**
- የትኛው በደንብ ሰራ?

- በደንብ ያልሰራው ምንድነው?
- ምን የተሻለ ያደርገው ነበር?
- ይህ እንዴት ተፅዕኖ አደረገብዎ?
- የመጠለያው የኮቪድ-19 ምርመራ እና የማስክ አጠቃቀም/ማህበራዊ ርቀትን መጠበቅ ጠቀሙ ወይም አልጠቀሙም?
- (ለምሳሌ፣ በራሪ ወረቀቶች፣ የመረጃ ሳጥኖች)

b) አሁን ከመጠለያው ሰራተኛ ጋር ስላለው ግንኙነት እጠይቅዎታለሁ፡፡ እባክዎን መጠለያው ስለኮቪድ-19 መረጃ እና ውጤቶች እንዴት ይነጋገር እንደ ነበር ሊያብራሩ ይችላሉ? **ያበረታቱ:**
- የትኛው በደንብ ሰራ?
- በደንብ ያልሰራው ምንድነው?
- ምን የተሻለ ያደርገው ነበር?
- ይህ እንዴት ተፅዕኖ አደረገብዎ?
- የመጠለያው የኮቪድ-19 ምርመራ እና የማስክ አጠቃቀም/ ማህበራዊ ርቀትን መጠበቅ ጠቀመ ወይም አልጠቀመም?
- (ለምሳሌ፣ በራሪ ወረቀቶች፣ የመረጃሳ ጥኖች)

c) አሁን ስለኮቪድ-19 ክትባቶች እንጠይቃለን፡፡ እዚህ የኮቪድ-19 ክትባቶችን በመውሰድ የሰዎች ተሞክሮ ምን ይመስል ነበር? **ያበረታቱ:**
- የትኛው በደንብ ሰራ?
- በደንብ ያልሰራው ምንድነው?
- እንዴት ነበር የሄደው?
- ምን የተሻለ ያደርገው ነበር?

6. የመዝጊያ አረፍ ተነገር

ይህም የዛሬውን ንግግራችንን ያጠቃልላል፡፡ የትኛውም ጥያቄ፣አስተያየት ወይም በመጨረሻ ሊያካፍሉን የሚፈልጉት ሀሳብ አልዎት? ስለተሳትፍዎ አሁንም በድጋሚ እናመሰግናለን፡፡

ሌሎች ጥያቄዎች ወይም የሚያሳስብዎት ነገር ካለዎ፣ፕጀክታችንን በ[**ስልክቁጥር**] ላይ ሊደውለት ይችላሉ፡፡ ይህንን ክፍለ ጊዜ ከማጠናቀቅ በፊት፣የማካፍልዎት ጥቂት አስተዳደራዊ/ የብዝነስ ዝርዝሮች አሉኝ፡፡

7. የአስተዳደራዊ ዝርዝሮች

- **በስጦታ ካርዶች ላይ መረጃ አቅርብ.**
- **ሌሎች የአስተዳደራዊ ዝርዝሮች**

የመቅጃ ፕሮቶኮል

- **ቃለ መጠይቁን ከመጀመርዎ በፊት እና በኋላ የ ZOOM መቅጃውን ይሞከሩት**

የቃለ መጠይቅ ፕሮቶኮል

- **ፅሁፉን ይመልከቱት እና አድስ ጭብጥ ካገኙ ወይም አዲስ የሚሰብ እይታ ካገኙ ተከታይ ጥያቄ ያቅርቡ፡**
  - *"ይህ በጣም ደሰ ይላል፣ ሰለሱ የበለጠ ልነግሩኝ ይችላሉ?"*
  - *"ይህንን እና ያንን (xyz) ብለው ጠቅሰዋል፣ያ ማለት ምን ማለት እንደሆነ የበለጠ ልገልፁ ይችላሉን?"*
  - *"አመሰግናለሁ፣ያ በጣም ጠቃሚ ነው፡፡"*
  - *"በትክክል ተረድቼው ከሆነ፣ ይንን ለማለት ነው ...."*
- **ማስታወሻ መያዝ**

Appendix A5. Interview Guide – Tigrinya

ሰላም፡ ስመይ_____ እዩ። ምስ [DEIDENTIFIED] ሲያትል ናይ ሰዓል መጽናዕቲ እየ ዝሰርሕ። ሎሚ ብዛዕባ እቲ ኣብ ክንክን ጥዕና ዘሎካ ሓሳባትን ተመክሮታትን ምእንቲ ክንፈልጥ ምሳኻ ክንዘራረብ ንደሊ ኢና። ብፍላይ ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት ዝያዳ ኽንፈልጥ ንደሊ ኢና። ኣብ መዕቄቢ ኣውራጃ ሲያትል ኪንግ እውን ምስ ካልኦት ሰባት 29 ቃለ - መጠይቓት ክንገብር ኢና። ርእይቶኻ ኣኽቢርና ኢና እንርእዮ። ብዛዕባ ስምዒታትን ተመክሮታትን ናይ ኮቪድ-19፣ ክታበታት ከምኡውን ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት ብዝሓሸ መገዲ ንኽንርዳእ ክሕግዘና እዩ። ብዘይካዚ እቶም ክታበታት ንዓኻን ንማሕበረሰብካን ጥዕና ኣብ ምዕቃብ ብኽመይ ግደ ኽም ዘለዎም ንኽንርዳእ ክሕግዘና እዩ።

ነቲ ብጽሑፍ ዝሰፈረ ፍቓድ መርምሮ ካብኡ ድማ ፍቓድ ናይ ድምጺ/ምስሊ ቅዳሕ ተቐበል። ንዝኾነ ይኹን ኣብኡ ክሳተፍ ዘይደሊ ሰብ ኣመስግኖ።

ሎሚ እንገብሮ ዝርርብ 30-60 ደቒቕ ኣቢሉ እዩ ዝወስድ። ፍቓድካ እንተ ኾይኑ ሎሚ እንገብሮ ዝርርብ ቅዳሕ ክምዝግብ እደሊ። መዘኻኸሪታት ክንጽሕፍ ንጽዕር እኳ እንተ ኾነና ኩሉ ሳዕ ግና ምሉእ ኣይኮነን። ክቅዳሕ ዘይትደልዮ ሓሳብ ክትህብ እንተ ደሊኻ ንገረኒ እሞ ኣነ ነቲ መመዝገቢ ቅዳሕ ከጥፍኦ እየ። ድሕሪኡ ሓሳብካ ምስ ወዳእካ እንደገና ክጀምሮ እየ። እዚ ሓሳብ ጽቡቕ ድዩ?

ሎሚ ኣብዚ እንዛረቦ ዝኾነ ይኹን ነገር ምስጢር ምኽኑ ኣይትረስዕ። እቲ እተካፍለኒ ነገራት ምስቲ ኻልኦት ተሳተፍቲ ዝህብዎ ሓበሬታ ክድመር እዩ። በዚ መገዲ ነቲ ብደረጃ ውልቀ ሰብ እተዛረብካዮ ነገር ዋላ ሓደ ኣይክፈልጦን እዩ። ቅድሚ ምጅማርና ገለ ሕቶታት ኣሎካዶ?

- ነቲ ናይ ምስሊ መመዝገብ ኣጀምሮ -

[ኣብ መጀመርታ እቲ መቕድሒ ቃለ መጠይቕ ዝገብረሉ ሰብን ፍሉይ መለለዩኡን ግለጽ ንኣብነት፡-, "SSI_OP_TM_2021-06-25"]

ሕጂ ኽንጅምር ኢና። ብድምጺ ኽትቅዳሕ ከም ዝተሰማማዕካ ኽተረጋግጽ ትኽእል'ዶ?

1. ብዛዕባ ስርዓት ጥዕና ንዘሎ ኣረኣእያን ናይ ጥዕና ክንክን ምድላይን ዝምልከት ሓፈሻዊ ሕቶታት

ብዛዕባ እቲ ኣብ ክንክን ጥዕና ዘሕለፍካዮ ተመክሮታት ሓፈሻዊ ሕቶታት ክሓትት ክጅምር እየ።

a) ክትሓምም ከለኻ ወይ ክንክን ጥዕና ከድልየካ ኽሎ መብዛሕትኡ ግዜ ናበይ ከም እትኽይድ ክትነግረኒ ትኽእል'ዶ?
b) ኣብ ቀረባ እዋን ኣገልግሎታት ክንክን ጥዕና ዝረኽብካሎም ተመክሮታት ክትገልጾም'ዶ ምኽኣልካ? **ምርመራ:**
    - ኣወንታዊ ወይ ኣሉታዊ ተመክሮታት ድዮም ኔሮም?
c) **[ናብ ኣሉታዊ ተመክሮታት ኣምርሕ እንድሕር ድኣ ኣብ 1B ተጠቒሱ]**. ክንክን ጥዕና ኣብ ዘድልየካ እዋን ንምርካብ ዘጸገመካ እንታይ ምኽኑ ኽትገልጾ'ዶ ምኽኣልካ? **ምርመራ:**
    - እንታይ እዩ ዝዓግት?
    - ክንክን ጥዕና ናብ እትረኽበሉ ክሊኒክ ብኽመይ ኢኻ ትኽይድ? ናብ ክሊኒክ ንምኻድ ምስ መጉዓዝያ ዝተተሓሓዘ ጸገማት ኣጋጢሙካ'ዶ ይፈልጥ?
    - ክንክን ጥዕና ንምርካብ ዝቐለለ ዝገብሮ እንታይ እዩ?
d) ኣገልግሎት ጥዕና ንምርካብ ዘሕለፍካዮ ተመክሮ ነቲ ብዛዕባ ክንክን ጥዕና ዘሎካ ስምዒትን ኣተሓሳስባን ዝጸለዎ ብኽመይ እዩ?

e) ብዛዕባ ጥዕና ዝያዳ ክትፈልጥ ወይ ብዛዕባ ጥዕናኻ ክትሓትት እንተ ደሊኻ እንታይ ኢኻ እትገብ? **ምርመራ:**
   - ናበይ ኢኻ እትኸይድ?
   - ናብ መን ኢኻ እትኸይድ?
   - ንምንታይ ኢኻ እትኸይድ?

2. ብዛዕባ ተመክሮታትን ከምኡ ውን ምርዳእን ክታበት ሓፈሻዊ ሕቶታት

ሕጂ ብዛዕባ እቲ ምስ ክታበት ዝተተሓሓዘ ተመክሮታትካ ሕቶታት ክሓትተካ እየ።

a) እናዓበኻ ኸለኻ ብዛዕባ ክታበት ዝረአኻዮ ወይ ዝሰማዕካዮ ግለጽ። **ምርመራ:**
   - ቁልዓ ኣብ ዝነበርካሉ እዋን ክታበት ወሲድካ'ዶ?
   - ኣረኣእያ ኻልኦት ነቲ ብዛዕባ ክታበት ዘሎካ ሓፈሻዊ ስምዒት ወይ ኣተሓሳስባኻ ዝጸለዎ ብኸመይ ኢዩ?

b) ብሓጺሩ ኣብ ምሉእ ህይወትካ ብዛዕባ ክታበት ዝረኽቦካዮ ተመክሮ ኽትነግረኒ ትኽእል'ዶ? **ምርመራ:**
   - ብዛዕባ እቲ ቕድሚ ሕጂ ዘጋጠመካ ናይ ክታበት ተመክሮታት (ቁልዓ ከለኻን ምስ ዓበኻን) ክትሓስብ ከለኻ እንታይ ኢዩ ጐሊሑ ዝግለጽ? ኣብ ሕቡራት መንግስትታት ኣመሪካ ወይ ኣብ ካልኦት ሃገራት?)
   - ዝኹነ ይኹን ኣጸጋሚ ኵነታት ግለጽ።

3. ብዛዕባ ጽልዋ ኮቪድ-19፣ ሓበሬታ ምድላይ፣ ክንክን ምድላይን ከምኡ ውን ግንዛበን ዝለዓሉ ሕቶታት

ሕጂ ብዛዕባ እቲ ምስ ኮቪድ-19 ዘሕለፍካዮ ተመክሮን ብዛዕባኡ ሓበሬታ ኣበይ ከም ዝረኸብካን ክሓትተካ ኢየ።

a) ብሒደት ቃላት እቲ ኮቪድ-19ን ናቱ ለብሚን ንዓኻን ንመነባብሮኻን ዝጸለዎ ብኸመይ እዩ? **ምርመራ:**
   - እንታይ እዩ ተቐዪሩ?

b) እዚ ዝስዕብ ከም እትጥቀም ጠቒስካ ኣለኻ **[ኣብ ላዕሊ ዝተገለጹ ምንጭታት ኣብ 1d]** ንናይ ጥዕና ሓበሬታ። ብዛዕባ ኮቪድ-19 ሓበሬታ ንምርካብ ዝተጠቐምካሉ ምንጭታት እዚ ድዩ ወይስ ካልእ ምንጭታት ኣሎ? **ምርመራ:**
   - ምንጭታት እዞም ዚስዕቡ ከጠቓልሉ ይኽእሉ፡- ቀንዲ ኣላዪ ክንክን፣ ቲቪ፣ ረድዮ፣ ኢንተርነት/ማሕበራዊ መራኸቢ፣ ኣባላት ማሕበረሰብ (ንኣብነት ስድራ ቤት፣ ፈተውቲ፣ ቤተ-ክርስትያን፣ ካልኦት ተቐማጦ)፣ ሰራሕተኛታት ፕሮግራም

c) ብዛዕባ ኮቪድ-19 ሓበሬታ ንምርካብ ልዕሊ ዅሉ እትኣምኖም ምንጭታት እንታይ እዮም? **ምርመራ:**
   - ብዛዕባ ሕማም ኮቪድ-19 ሓበሬታ ንምርካብ ነዞም ምንጭታት እዚኣቶም ክሳዕ ኽንደይ ኢኻ እትኣምኖም?
   - ንምንታይ?

ሕጂ ብዛዕባ መርመራ ኮቪድ-19 ክሓትተካ እየ።

d) ነቲ ኣብ ናይ ኮቪደ-19 መርመራታት ዘሕለፍካዮ ተመክሮታት ክትገልጾ'ዶ ምኽኣልካ? **ምርመራ:**
   - ብዛዕባ እቲ ኮቪድ-19 መርመራታት ከመይ ይስምዓካ/ትሓስብ?
   - ሓደ ጊዜ ክትምርመር ደሊኻ ኣብ ናይ ኮቪድ-19 መርመራ ንምግባር ገለ ጸገማት ኣጋጢሙካ'ዶ ዋላ (ንኣብነት መጓዓዝያ ወይ ርሕቐት ናብ ክሊኒክ ናበይ ከም እትኸይድ ርግጸኛ ኣይነበርካን)?
   - ናይ ኮቪድ-19 መርመራ ንኽገብር ንዓኻ ዝቐለለ ዝገብረልካ እንታይ ኢዩ? ንኻልኦት'ከ?

ሕጂ ብዛዕባ ክታበት ኮቪድ-19 ክሓትተካ እየ።

e) ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት እንታይ ሰሚዕካ ትፈልጥ? **ምርመራ:**
   - ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት ዝሰማዕካዮ ጽቡቕ ነገራት ክትገልጾም'ዶ ምኽኣልካ?
   - ምስ ናይ ኮቪድ-19 ክታበት ዝተተሓሓዘ ሻቕሎታት ክትገልጾም'ዶ ምኽኣልካ?
   - ድሕሪ ግዜ ዘተሓሳስበካ ነገራት ዝተቐየረ ብኸመይ እዩ?
   - ነቲ ለውጥታት ዝጸለዎ እንታይ እዩ?

f) ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት እትኣምኖ ሓበሬታ ኣበይ ረኺብካ? **ምርመራ:**
   - ብዛዕባ ሕማም ኮቪድ-19 ሓበሬታ ንምርካብ ነዞም ምንጭታት እዚኣቶም ክሳዕ ኽንደይ ኢኻ እትኣምኖም?
   - ንምንታይ?

- ልዕሊ ዅሉ ኣገዳስቲ/ሓገዝቲ/እሙናት ዝኾኑ ኣየነዎት ይመስለካ?
- ትሕቲ ዅሉ ኣገዳስቲ/ሓገዝቲ/እሙናት ዝኾኑ ኣየነዎት ይመስለካ?
- ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበታት እንታይ ሓበሬታ ዝተረኽበ ኣሎ/ክርከብ ይከኣል?

g) ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት እትኣምኖ ሓበሬታ ኣበይ ረኺብካ?

h) ኣብ ከባቢኻ ዘለዉ ሰባት ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበታት ከመይ ይስምዖም ወይ ይሓስቡ? **ምርመራ:**
- ኣብ ከባቢኻ ዘለዉ ሰባት ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት ኣወንታውን ኣሉታውን ዝኾነ ሓሳባት እንታይ ክብሉ ሰሚዕካ?
- ብዛዕባ እቲ ኮቪድ-19 መርመራታት ከመይ ይስምዓካ/ትሓስብ?
- ርእይቶ ኻልኦት ምስ ሰማዕካ ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት ዘሎካ ርእይቶ ብኽመይ ቀይርካዮ?

i) ናይ ኮቪድ-19 ክታበት ክትረክብ ከም ዘሎካን ከም ዘይብልካን ድሕሪ ግዜ ስምዒታትካን ሓሳባትካን ብኽመይ ተቐዪሩ? **ምርመራ:**
- ሓሳባትካ ዝቐየረ እንታይ ወይ መን ከም ዝኾነ ብዝያዳ ንገረኒ። ብኽመይ?
- ስለምንታይ ውሳነ ትገብር ከም ዘለኻ/ከም ዝገበርካ ግለጽ።
- **[ብዛዕባ ኮንተይነም ክታበት ርእይቶ ንምርካብ ስእሊ ኣርእዮ]**
- ስምዒታትካን ሓሳባትካን ብኽመይ ከም ዝተቐየረ በዚ ስእሊ እዚ ኽተርእየኒ ትኽእል'ዶ?
- ኣብዚ እዋን እዚ ኣብዚ ስእሊ ኣበይ ከም ዘለኻ ኼይኑ እዩ ዝስምዓካ?
- እዚ ኻብቲ ኣብ ዝሓለፈ እዋን (ካብ ሕጂ ዝተፈልየ እንተ ኼይኑ) ዝስምዓካ ዝነበረ ስምዒት ዝፍለ ብኽመይ እዩ?

j) ሰባት ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት ዘለዎም ሕቶታት ክንእክብ ንጽዕር ኣሎና። ብዛዕባ እቲ ናይ ኮቪድ-19 ክታበት ገለ ነገር ክትፈልጥ እንተ ትኽእል እንታይ ክትፈልጥ ምደለኻ? **ምርመራ:**
- መልሲ ዘይተዋህበካ ሕቶታት እንተሃልዩ ብክብረትካ ግለጽ።
- ሎሚ ነዚ ሕቶታት እዚ ኽንምልሶ ኣይንኽእልን ኢና። እንተኼነ ግን እዚ ኣብ መጻኢ ኣብ ዝበጽሐና ጭብጥታት ክጠቓለል ተስፋ ንገብር።

4. ብዛዕባ ናይ ኮቪድ-19 ክታበትን ከምኡ ውን ድሕሪ ጊዜ ዝግበር ንጥፈታትን ዝምልከት ሕቶታት

[*ገለ ኻብቶም ክታበት ክወሰዱ መደብ ዘውጽኡ/ክታበት ዝወሰዱ*]

a) ብመሰረት እቲ ኣቐዲምካ ዝገበርካዮ መጽናዕቲ ስለምንታይ ናይ ኮቪድ-19 ክታበት ኽትቅበል ከም ዝመደብካ/ከም ዝመረጽካ ኽትነግረኒ ትኽእልዶ? **ምርመራ:**
- ስለምንታይ ኢኻ ጸረ ኮቪድ-19 ክታበት ዝወሰድካ/ክትወስድ እትደሊ?
- ክታበት ንኽትወስድ ዝወሰንካ ብኽመይ ምኽኑ ግለጽ።

b) ኮቪድ-19 ክታበት ክትወስድ ከለኻ ዘሕለፍካዮም ተመክሮታት ክትገልጾም'ዶ ምኽኣልካ?
- ናይ ኮቪድ-19 ክታበት ክትቅበል እትደሊ እኳ እንተ ኼንካ ክትረኽቦ ዘጸግመካ ነገራት ነይሩ'ዶ (ንኣብነት መጓዓዝያ ወይ ርሕቐት ናብ ክሊኒክ ናበይ ከም እትኽይድ ርግጸኛ ኣይነበርካን)?
- ናይ ኮቪድ-19 ክታበት ንምውሳድ ዝቐለለ ዝገብረልካ እንታይ ኢዩ?
- ካልኣይ ጊዜ ክታበት ንክትረክብ ገለ ጸገማት ነይሩካ'ዶ?

[*ገለ ኻብቶም ክታበት ንኽወሰዱ ዘይሓሰቡ/ዘይወሰኑ*]

c) ነቲ ናይ ኮቪድ-19 ክታበት ንምርካብ ሓሳብካ ንክትቅይር እንታይ የድልየካ? **ምርመራ:**
- ሓሳብካ ክቕይር ዝኽእል ዝኼነ ይኹን ነገር ግለጽ (ንኣብነት ገንዘብ፣ ናይ ሕማም ዕረፍቲ፣ ብስራሕ ዝድለ ብቐዓት፣ ንዓይ ዝቐርበኒ ሰብ ዝሓመመ/እተቓልዐ ምኽኑ፣ ወዘተ።)
- ልዕሊ ዅሉ ዘገድስ እንታይ እዩ?

[ኣብ መንነ ተሳተፍቲ ምስ ኣብ ትሕቲ ክንክን ዘሎ(ዘለው) ቆልዓ (ዉ)፡ ከምቲ ኣብቲ ተግባር ዝዋዕለ መጽናዕቲ ዝሓበሮ]

d) ንውሉድካ ጸረ ኮቪድ-19 ክታበት ንምኽታብ ዘሎካ ሓሳባት ክትገልጾ'ዶ ምኽኣልካ? **ምርመራ:**
c. ብዛዕባ እዚ ዝያዳ ንገረኒ (ንኣብነት ክህሉ ዝኽእለሉ፣ ክርከብ ዝኽእል ምኽኑ፣ ብቑዕ ምኽኑ)።

5. [*ኣብ መንነ ሰራሕተኛታት ጥራይ*] ብዛዕባ ትካላዊ ስትራተጂ ጸረ ኮቪድ-19 ዝለዓሉ ሕቶታት

ሕጂ እዚ መዕቈቢ እዚ ብዛዕባ ኮቪድ-19 ዘለዎ ግንዛበ ከመይ ከም ዝኾነ ክሓትተካ እየ። እቲ እትህቡ መልሲ ስም-ኣልቦ ከም ዝኾነ ኣይትረስዕ። ስምካ ምስዚ መልስታት እዚ ኣይተሓሓዝን እዩ ወይ ካብ ጉጅለ ምርምር ወጻኢ ንዝርከብ ዝኹነ ይኹን ሰብ ኣይነካፍሎን ኢና።

a) እቲ መዕቈቢ ምስ ተቐማጦን ሰራሕተኛታትን ብኽመይ ከም ዝራኽብ ክፈልጥ እደሊ እየ። ካብ ተቐማጦ ንጀምር። እቲ መዕቈቢ ነቶም ተቐማጦ ብዛዕባ ሓበሬታን ሕግታትን ኮቪድ-19 ብኽመይ መንገዲ ከም ዘዘራርቦም ክትገልጸም'ዶ ምኽኣልካ? **ምርመራ:**
   - እንታይ እዩ ጽቡቕ ውጽኢት ዝረኽበ?
   - እንታይ እዩ ጽቡቕ ውጽኢት ዘይረኽበ?
   - እንታይ ነገር ካብዚ ዝሓይሽ ምገበሮ?
   - እዚ ብኽመይ ጸልዩካ?
   - እቲ ኣብቲ መዕቈቢ ዘሎ ናይ ኮቪድ-19 መርመራ ከምኡ ውን ማስኬራ ኣጠቓቕማ/ማሕበራዊ ርህቀት ምሕላው ብኽመይ ኢዩ ዝትግበር ወይ ዘይትግበር ዘሎ?
   - (ናኣብነት:- በራሪ ወረቐት፣ ናይ ሓበሬታ ናቕጣ)

b) ሕጂ ብዛዕባ እቲ መዕቈቢ ምስ ሰራሕተኛታት ዘለዎ ርክብ ክሓትተካ እየ። እቲ መዕቈቢ ነቶም ተቐማጦ ብዛዕባ ሓበሬታን ሕግታትን ኮቪድ-19 ብኽመይ መንገዲ ከም ዘዘራርቦም ክትገልጸም'ዶ ምኽኣልካ? **ምርመራ:**
   - እንታይ እዩ ጽቡቕ ውጽኢት ዝረኽበ?
   - እንታይ እዩ ጽቡቕ ውጽኢት ዘይረኽበ?
   - እንታይ ነገር ካብዚ ዝሓይሽ ምገበሮ?
   - እዚ ብኽመይ ጸልዩካ?
   - እቲ ኣብቲ መዕቈቢ ዘሎ ናይ ኮቪድ-19 መርመራ ከምኡ ውን ማስኬራ ኣጠቓቕማ/ማሕበራዊ ርህቀት ምሕላው ብኽመይ ኢዩ ዝትግበር ወይ ዘይትግበር ዘሎ?
   - (ናኣብነት:- በራሪ ወረቐት፣ ናይ ሓበሬታ ናቕጣ)

c) ሕጂ ብዛዕባ ኮቪድ-19 ክክታበት ክንሓትተካ ኢና። ኣብዚ ሰባት ነቲ ናይ ኮቪድ-19 ክታበት ንምውሳድ ዘሕለፍዎ ተመክሮ እንታይ ይመስለካ? **ምርመራ:**
   - እንታይ እዩ ጽቡቕ ስራሕ ዝኾነ?
   - እንታይ እዩ ጽቡቕ ስራሕ ዘይኮነ?
   - ብኽመይ እዩ ተኻይዱ?
   - እንታይ ነገር ካብዚ ዝሓይሽ ምገበሮ?

6. *መዛዘሚ ሓሳባት*

እዚ ኸኣ ነቲ ሎሚ ዝገበርናዮ ዝርርብ ይዛዝሞ። ከተካፍሎ እትደሊ ሕቶታት፣ ርእይቶታት ወይ ናይ መወዳእታ ሓሳባት ኣሎካ'ዶ? ስለቲ ዝገበርካዮ ተሳትፎ እንደገና ነመስግነካ።

ካልእ ሕቶታት ወይ ሻቕሎት እንተ ኣልዩካ ንፕሮጀክትና ክትድውለሉ ትኽእል ኢኻ ኣብ [**ቁጽሪ ቴለፎን**]። ነቲ ፕሮግራም ቅድሚ ምዝዛምና ከካፍለካ ዘሎኒ ሒደት ናይ ምምሕዳራዊ/ንግዳዊ ዝርዝራት ኣሎኒ።

7. ናይ ምምሕዳራዊ ዝርዝራት

- **ብዛዕባ ናይ ህያብ ካርድታት ሓበሬታ ሃብ.**
- **ዝኾነ ካልእ ናይ ምምሕዳራዊ ዝርዝራት**

ናይ መመዝገቢ ውዕሊ

- **ቅድሚ እቲ ቓለ-መጠይቕ ናይ ዙም(ZOOM) መቅድሒ ፈትኖ ካብኡ ድማ ምቕዳሕ ጀምር**

ናይ ቃለ - መጠይቕ ዘካይድ ውዕሊ

- **ሓድሽ ፍረ ነገር ወይ ሓድሽ መሳጢ ኣረኣእያ ምስ እትረክብ ነቲ ጽሑፍ ስዓቦ ከምኡ ውን ብሕቶታት ኣሰንዮ፡-**
    - *"እዚ ዝገርም እዩ ብዛዕባ እዚ ዝያዳ ኽትነግረኒ ትኽእል'ዶ?"*
    - *"xyz ጠቒስካዮ ኣለኻ እዚ እንታይ ማለት ምኽኑ ቕሩብ ክትገልጸለየ ትኽእል'ዶ?"*
    - *"እዚ ብጥዕሚ ጠቓሚ እዩ ነመስግነካ።"*
    - *"ኣብ ከምዚ ዝኣመሰለ ደረጃ እንተ በጺሐ እዚ ማለትኩ..."*
- **መዘኻኸሪ ምውሳድ**

Appendix B. Focus Group Guide – English

WELCOME PARTICIPANTS AS THEY ENTER THE ROOM.

Hello, my name is_____, I work with the [DEIDENTIFIED] Seattle Flu Study. Today we want to talk with you to learn about your thoughts and experiences with healthcare. Specifically, we want to know more about COVID-19 vaccination. We will also meet with four-five other groups of residents at different shelters. We value your opinion. It will help us better understand how people in this shelter feel about COVID-19 testing and COVID-19 vaccination. It will especially help us understand how these feelings have changed over time and help us to address any concerns. It will also help us understand how vaccines can play a role in keeping you and your community healthy.

REVIEW WRITTEN CONSENT FORM AND RECEIVE AUDIO/VISUAL CONSENT. THANK ANYONE WHO DECIDES NOT TO PARTICIPATE.

This discussion will be audio recorded. We try to take notes, but they are not always complete. Please feel free to share your ideas and opinions even if they are different from others. All views and ideas are important. We would like to get as many different points of view as we can. Since this is a group discussion you do not have to wait for me to call on you to speak, but please try to speak one at a time. If two people begin talking at the same time, I may pause us so that we can hear everyone on the tape recorder. Please remember that all your answers are confidential. To respect others' privacy, please keep what is said by others in this conversation in this room.

BRIEF INTRODUCTION

To begin, let's go around the circle and have each of you tell us your first name, and if you like, why you are here. I'll start ….

From now on, we will refer to each of us with a different name to maintain confidentiality for the recording. Can you each pick a superhero or movie character name? For example, "Superman", "Batwoman"…etc. Please write this new name on your name tag and place it in front of you. To start, we will each introduce ourselves as this new name and tell why we picked it. Please refer to the other individuals with this name (rather than their real name). I'll start...

- START THE VIRTUAL RECORDER –

[INTERVIEWER ASSIGN AND STATE UNIQUE IDENTIFIER AT THE BEGINNING OF THE RECORDING E.G., "FGD_OP_2021-06-25"]

We will now begin. Can you confirm that you agree to be audio recorded?

8. QUESTIONS ABOUT COVID-19 PERCEPTIONS AND INFORMATION SEEKING

I am going to start with some questions about thoughts around COVID-19 here. I will also ask about sources of COVID-19 information you trust.

a) What have you seen or heard others say about masks and social distancing here? **Probe:**
   - How do people feel/think about masks?
   - How do people feel/think about social distancing?
   - How have [these things] influenced how you feel/think about masks and social distancing?

b) What you have seen or heard others say about COVID-19 testing here? **Probe:**
   - How do people here feel/think about COVID-19 testing?
   - How have these [these things] influenced how you feel/think about COVID-19 testing?

c) [SHOW FLIP-CHART WITH EACH INFORMATION SOURCE LISTED] How much do you trust these sources for information on COVID-19 disease? **Probe:**
   - Which do you trust? Why?
   - Which source do you trust the most? Why?
   - Which do you not trust? Why?
   - What source do you trust the least? Why?
   - Are there any sources missing?
   - Can you tell me some reasons why you [trust/mistrust] this information?

d) [SHOW FLIP-CHART WITH INFORMATION SOURCES THAT ARE VACCINE SPECIFIC] How much do you trust these sources for information on COVID-19 vaccines? **Probe:**
   - Which do you trust? Why?
   - Which source do you trust the most? Why?
   - Which do you not trust? Why?
   - What source do you trust the least? Why?
   - Are there any sources missing?
   - Can you tell me some reasons why you [trust/mistrust] this information?

e) What are your thoughts on COVID-19 policies in Washington State (e.g., public health/government mandates)? **Probe:**
   - Mask requirements/mandates?
   - Vaccine requirements /mandates?
   - FDA approval of boosters?

9. QUESTIONS ABOUT COVID-19 VACCINE FEELINGS AND CONCERNS

Now, I am going to ask you some questions about how people here feel/think about COVID-19 vaccination.

a) What have you seen or heard others say about COVID-19 vaccines here? **Probe:**
   - How do people feel/think about COVID-19 vaccination?

- How have [these things] influenced how you feel/think about COVID-19 vaccination?

b) What makes it easier for people experiencing homelessness to get a COVID-19 vaccine?
c) What makes it hard for people experiencing homelessness to get a COVID-19 vaccine?
d) **[SHOW PICTURE TO GET FEEDBACK ON VACCINE CONTINUUM]** How do you think this picture shows how people here at this shelter feel/think about COVID-19 vaccines?
e) How have people's feelings/thoughts about COVID-19 vaccines changed since vaccines became available? Why? **Probe:**
- Are people more or less likely to accept vaccines and/or get vaccinated now?
- What has made a difference?

f) What or who specifically has influenced your thoughts on COVID-19 vaccine to change?
g) Please describe reasons why people are not taking the vaccine. **Probe:**
- What have you heard?

h) For those who are undecided or do not want to receive a vaccination, what do you think might change how they feel/think about getting the vaccine? **Probe:**
- Describe anything that might change someone's mind...
  - Material items? (e.g., money, sick leave
  - Mandate? (e.g., requirement for work, travel, healthcare)
  - Information? (e.g., educational event)
  - Personal experience? (e.g., someone close to me is sick/susceptible, outbreak at shelter or shelter nearby)
- What do you all think of that option?
- Do you think incentives would improve vaccination?
- What types of incentives might be most effective?
- What types of incentives should not be offered?
- Is there a specific amount of money as an incentive that would convince people at this shelter to be vaccinated? If so, how much?
  - (e.g., $10? $50?)

10. QUESTIONS ABOUT ORGANIZATIONAL STRATEGY AGAINST COVID-19

Now, I am going to ask you some questions about how this site has dealt with COVID-19. Remember, your answers will be anonymous. Your name will not be attached to these answers or shared with anyone outside the research team.

a) Can you please describe how the site has communicated with residents about COVID-19 information and rules? **Probe:**
- What worked well?
- What did not work well?
- What would have made it better?
- Please describe any recommendations for how the shelter could better communicate to residents.
- How has this affected you?
- How has the COVID-19 testing and mask use/social distancing been working or not working here?
- (E.g., flyers, information booth)

b) Now we will ask about COVID-19 vaccination. What do you think people's experience here was with getting the COVID-19 vaccine? **Probe:**
- What has worked?

- What has not worked?
- How did it go?
- What would have made it better?

11. QUESTIONS ABOUT SITE EVENTS RELATED TO COVID-19

Now, I am going to ask you some questions about events here related to COVID-19. First, we will focus on events related to COVID-19 testing.

a) How do you feel/think about the COVID-19 testing that took place here? **Probe:**
- Can you describe what you remember about the events?
- Who led these events?
- What did you like about these events?
- What could have been better about these events?
- How do you think others here felt/thought about these events?
- Were there any other events that you participated in that affected your opinion of COVID-19 testing?

b) How did these events affect your opinion or decision to get tested for COVID-19? **Probe:**
- What changed?
- Why?
- Has anything from these events changed how you think about COVID-19 testing?
- Has anything from these events changed whether you get COVID-19 testing?

Next, we will focus on events related to COVID-19 vaccination.

c) What activities or events have happened here for promoting COVID-19 vaccination? This includes general education/outreach and can be events held by the staff here, or by external folks like those from the health department. **Probe:**
- Were there any other events that you participated in that affected your opinion of COVID-19 vaccination?
- How do you think others felt about these events?
- What did you like about these events?
- What could have been better about these events?
- Who led these events?
- Can you describe what you remember about the event?

d) How did these events affect your opinion or decision to get vaccinated against COVID-19? **Probe:**
- Has anything from these vaccine events changed how you think about COVID-19 vaccines?
- Has anything from these vaccine events changed whether you get a COVID-19 vaccine?
- Why?

12. QUESTIONS ABOUT COVID-19 WORDING

a) What is the best wording to describe someone who is undecided about vaccination? **Probe:**
- Some words we've heard include deliberative, contemplative, hesitant.

b) What is the best wording to describe someone who does not want a vaccine? **Probe:**
- What do you think of when you hear the word “vaccine hesitant”?
- What do you think of when you hear the word “vaccine deliberative”?
- What do you think of when you hear "vaccine resistant”? Vaccine abstinent?
- What do you think of when you hear the word “vaccine reluctant”?

c) Please describe reasons why people are not taking the vaccine. **Probe:**
- What have you heard?

13. CLOSING STATEMENT

That completes the conversation for today. Does anyone have any other questions, comments, or final thoughts they would like to share? Thank you again for your participation.

If anyone thinks of other questions or concerns, you can call the project number at [PHONE NUMBER]. Before we end the session, I have a few administrative/business details to share with you.

14. ADMINISTRATIVE DETAILS

1. PROVIDE INFORMATION ON GIFT CARDS.
2. ANY OTHER ADMINISTRATIVE DETAILS

RECORDER PROTOCOL

- TEST AUDIO RECORDER BEFORE THE FOCUS GROUP AND START RECORDING

FACILITATOR PROTOCOL

- **GO THROUGH SCRIPT AND FOLLOW UP WITH QUESTIONS WHEN YOU FIND A NEW THEME OR A NEW INTERESTING PERSPECTIVE:**
  - *"That's interesting, can you tell me more about that?"*
  - *"You mentioned xyz, can you explain a little further about what that means?"*
  - *"Thank you that is very helpful."*
  - *“If I’m getting at this right, it sounds like...”*

NOTE TAKER PROTOCOL

- NOTE THEIR FIRST AND LAST FEW WORDS
- NOTE ANY OTHER PARTICULAR COMMENTS THAT STAND OUT TO DISCUSS IN THE DEBRIEFING AFTER THE GROUP

Appendix C. Codebook

Code Name	*Category*	*Code Description*	*Inclusion/Exclusion Criteria*
Golden nuggets	0. QUOTES	This code captures great quotes to potentially highlight in analysis	N/A
a. healthcare setting	I. PREVIOUS EXPERIENCES WITH HEALTHCARE	~~This codes~~ describes where a participant usually goes when they get sick or need healthcare	This includes clinics/specific providers, urgent care, hospitals, ERs, pharmacies, non-traditional medicine
b. healthcare experiences		This code includes any mention of previous experiences with healthcare	This includes positive, negative, and neutral experiences
c. healthcare access		This code describes participant experience with accessing healthcare, such as what makes it easy/ hard for a participant to get healthcare when they need it	This includes mention of access facilitators, challenges, or no attempt to access health care
d. effect of experience on perception of healthcare		This code highlights how a participants experience getting health services may affect how they feel/think about healthcare	This includes comfort with or mistrust of healthcare. This excludes details about the experience itself.
e. health information seeking		This code captures participant preferences when wanting to learn more about a health topic or when they have a question about their health.	This includes where a participant goes, who they go to, and why they go to a particular location for information.
f. vaccine perceptions		This code describes what a participant saw or heard about vaccines in general throughout their life.	This includes childhood perceptions, adult perceptions, and other's influence on participant perceptions. This excludes perceptions about COVID-19 vaccines.
g. vaccine experiences		This code describes participant experiences with getting vaccines throughout their life, including what stands out about prior vaccination experiences and/or difficult experiences.	This includes experiences with childhood/adolescent/adult vaccines, and routine immunizations. This excludes experiences with COVID-19 vaccines.
a. heard about COVID-19 vaccines	II. COVID-19 TOPICS > 4. COVID-19 VACCINES	This code describes what a participant has heard about COVID-19 vaccines from any sources.	This includes both positive sentiments and concerns, as well as how what one has heard has changed over time and what influenced changes over time.
b. COVID-19 vaccine information sources		This code describes where a participant found information about COVID-19 vaccines, and their levels of trust and reasoning for trust or mistrust.	This includes all sources mentioned, both trusted and untrusted sources, as well as reasons for trust or mistrust.
c. COVID-19 vaccine perceptions		This code captures how a participant thinks/feels about COVID-19 vaccines. This also includes what the participant has heard from others around them (e.g., friends, family, co-workers).	This includes both a participant's personal perceptions and what they have heard about others' perceptions. Additionally, this includes influences on or changes in perceptions overtime (e.g., how opinion on COVID-19 vaccines has changed after hearing others' opinions)
d. COVID-19 vaccine position		This code describes a participants current vaccination intent and status for both self (and children where applicable), as well as how this intent has changed over time.	This includes description of how someone came to a decision to get vaccinated or why someone does not plan to be vaccinated, as well as change (or no change) in intent over time.
e. COVID-19 vaccine access		This code describes participant experience with accessing COVID-19 vaccines, such as what makes it easy/ hard for a participant to get a COVID-19 vaccine when they need or want it	This includes mention of access facilitators, challenges, or no attempt to access COVID-19 vaccine
f. COVID-19 vaccine decision making		This code refers to any description of a participants process to make a decision about getting vaccinated, including why they [are making/made] a particular decision, as well as how their feelings or thoughts have changed over time.	This includes how one's opinion was influenced and includes motivators, such as mandates, additional information, incentives.
g. COVID-19 vaccine experiences		This code describes any mention of experiences getting a COVID-19 vaccine	This includes positive, negative, and neutral experiences
h. COVID-19 vaccine questions		This code captures questions that participants have about COVID-19 vaccines.	This includes anything that the participant mentioned wanting to know about COVID-19 vaccines.
i. recommendations for helpful COVID-19 vaccine information		This code captures recommendations for additional information to improve communication about COVID-19 vaccine	This includes any recommended information, such as ways to clarify or details about boosters
a. positive	V. Interviewer Feedback	This code highlights interviewer techniques that are good examples for discussion and training purposes.	This includes re-focusing the participant, successful probing.
b. room for improvement		This code highlights interviewer techniques that are examples where there is room for improvement for discussion and training purposes.	This includes skipped questions, incorrect framing of questions, or need for further probing.

Appendix D. Supportive quotes

Table D1. Supportive quotes for perceptions of vaccines in general and COVID-19 vaccines*

1.1.1. Positive perceptions	
Accessible	*"**Schools had accessibility**…you didn't need to go to a doctor's office. You **didn't have to pay** for them because it was **in the public interest** for everyone to be getting those vaccines."* -Resident
Normal	*"Growing up, **everybody did it.** There was no issues. Vaccines were **just something you did.** It was just pretty much **normal."*** -Resident *"They were positive about it. **Everybody would get vaccination**"* -Staff
Effective	*"Everyone knew that vaccines prevented many diseases that had occurred in the past. Since we were little, we knew that if you get vaccinated, you're **protected against diseases**, so we all got vaccinated."* -Resident *"What [COVID-19 vaccines] do at the very, very least, **intensely improve the chance of serious hospital visits**. I think that is necessary for a pandemic situation."* -Resident
Necessary	*"I was told by medical professionals, you **need the vaccine so you don't get sick**. I didn't get sick. What does that tell you? A friend of mine, his parents didn't believe in any kind of vaccine. His mother lost a leg because of polio.*" -Resident *"It's a **necessary evil**. We have no other way right now to keep our civilization alive. We're watching what is happening to the unvaccinated. We're **going to decide who lives and dies**."* -Resident
Safe	*"I know it's an mRNA. It's been **in development for decades**. It just has not been marketed."* -Resident
Widely embraced	*"I have **friends and family that gotten it**, so I've asked them how their experience was. Then after researching and all that, I decided to get it."* -Resident
1.1.2. Negative perceptions	
Experimental	*"People are really **scared**. They're thinking hospitals and doctors is **guinea-pigging them** or experimenting on them, and you can't blame them being like that.*" -Staff *"My father used my brother and I **to get money as guinea pigs** for some messed up [vaccine] experiment."* -Resident
Anxiety provoking	*"I'm **scared of needles,** so it took me a while to just sit there and get a shot in my arm, because you're scared, you don't know what the shot's going to be like.* " -Staff "*I'd rather take medication by intake by mouth instead of vaccinations and **due to drug use, I never did needles***." -Resident
Harmful	"*I **still have the pain in this arm right here** and I didn't want to take no shot and I'm not going to take anymore*." -Resident *"The vaccine gave me pneumonia and blinded me for eight days, it took my eyesight away…I'm certain **vaccines are not good for my body**. After that, I don't take any more vaccines or anything*" -Staff

Forced	*"When I was in school, I was **brainwashed**. It was something that people had to do to go to a public school…it was **completely unnecessary,** but it wasn't discussed. They **forced it** on people when I was a kid. It's something I don't ever want to go through or have any children of mine ever go through"* -Resident *"I'm more **worried about what I put into my body** than before. I was a kid then and was **forced** to do things. I don't know too much about vaccines."* -Resident
Not necessary	*"I just never got in the habit of having vaccinations. **I have a good immune system**, I believe, because nobody's messed with it and it works the way it's supposed to work without all these extra additives. **I don't have any use for it**."* -Resident *"I have **increased my immunity system** four or five times its normal level. When I went to the VA, I was exposed, but I have antibodies against it. I have **no need for no vaccine**"* -Resident
For profit	*"There's a lot of propaganda, in the media, where they're trying to force people to do it…I consider that it was **done for money only** and not for healthcare reasons."* -Resident *"My vaccines I took in Brazil for free. It's literally cheaper buying the thousand-dollar ticket and go to **Brazil and you get it for free**."* -Staff
Rushed development	*"When the swine flu came out, that vaccine came out a little bit **too fast** and then they predicted a pandemic and it wasn't going to be a pandemic and a lot of people had **side effects**."* -Resident *"I was really scared, because I'm like, 'They **putting something in our bodies that we don't know nothing about.**'"* -Staff *"I'm a Black woman, I **didn't know if they had any studies in non-White people**. I don't think skin colour would change how a vaccine works, but I don't know. It was just a mild concern."* -Staff
Not effective	*"They're saying that **even if you are vaccinated, you can still catch COVID**. If the vaccine and the mask has less than 15% chance of protecting us"* -Resident (Focus group)
Malicious intent	*"They're **deceiving you and putting diseases in you** that won't ever come out, that 20 years down the ride, you'll see a commercial on the TV that's like, "If you or anyone you know has been impacted by the said vaccine, you may be entitled to compensation."* -Resident *"Some of my family members who got totally vaccinated, end up with COVID. **People dying have gotten their shots, dying from the shots**. I'm not saying these things to justify my fear of it, but you can believe **I'm afraid of it.**"* -Resident *"They're putting a **mind control chip in the vaccine** that goes straight to your brain. World **governments are tracking people.** It's right here in your hand while you're scrolling."* -Resident

* Perceptions in left column about *vaccines in general (italicized)*, **COVID-19 vaccines (bolded)**, and both ***vaccines in general and COVID-19 vaccines (italicized and bolded)***.

Table D2. Supportive quotes for reasons for COVID-19 vaccination intent and decision-making

1.2.1. Reasons to get vaccinated	
Fear of poor health outcomes	*"I'd rather take the chance of living than dying without it. If I'm going to die either way, I'd rather take a chance of having it, you know?"* -Staff *"It was finding myself in a tent city with massively dangerous people, and I couldn't trust them to keep myself or my son safe. We were going to be exposed on a regular basis, and* ***I just couldn't have us falling ill****. It wasn't time.* ***We didn't have the luxury of being sick****…At least with the vaccine, for right now we are protected, we'll make it through. So yeah,* ***becoming homeless absolutely had a huge play in how I went about looking at the vaccine.****"* - Resident
Desire to protect others	*"I don't want to spread it. I don't want to be potentially ill, go into a friend's house that hasn't been vaccinated and transmit it to them. If it doesn't need to spread, if there's a way to stop it, it needs to be done."* -Resident *"I have to do it for my kids and have to take another step to try to protect them."* - Resident (Focus group)
Desire to return to normal	*"I had to take the Johnson & Johnson because of the mask and due to not liking it all the time… here where I live, the mask is required."* -Resident *"My incentive for getting the vaccine was because I was in the Union Gospel Mission and in order for us to get out of the lockdown situation, you had to be vaccinated…but it did absolutely no good in releasing us from the lockdown."*- Resident (Focus group)
Requirement	*"I couldn't go to work because they tell us, 'If you don't take it, you can't go to work.*" -Resident *"I was maid of honor and the venue required it for the wedding party so then it came down to like, "I'm not going to miss her wedding because I wasn't willing to get a shot that eventually I'll probably end up having to get."* -Resident (Focus group)
1.2.2. Reasons not to get vaccinated	
Uncertainty of long term effects	*"There's not enough studies. People with different diseases, different ailments, one may be able to take it here but this one over here can't take it.."* -Resident (Focus group)
Reliance in natural immunity	*"I don't plan to be vaccinated. I'm healthy. I personally don't feel like I am affected by it. I played in the dirt a lot so I'm not surprised. I know my body. I know what it can take and how strong it is. That's just human immune system and how you treat yourself in general."* -Resident *"I think it would probably be harmful to start taking vaccines at 73 years of age. I don't think my system wants that."* -Resident
Competing demands	*"You're worrying about money, you're worried about making out of here, you're worried about finding a place, you're worried about doing all the things the shelter is making you do to be able to stay here. You're not worrying about "Oh, I need to go get the shot, so I can be okay," You're not worrying about, "Oh how am I going to get a ride to go get the shot"* ***No, you're not worried about none of that, you are worrying about life****. Stuff that other people will think about, you're thinking about can I get a shower tonight? Or somebody is going to be in the shower."* - Resident (Focus group)

Mistrust	*"They're being forced to take it by the government. It's also dictatorship. They're saying, "Take this or this will happen. Don't take this, this won't happen."."* -Resident (Focus group)
Religious beliefs	*"There are some people who don't and they're coming up with some sort of propaganda or maybe like they're religious."* -Resident (Focus group) *"More religious, it could be mark of the beast …which is some kind of emblem…a microchip... It's going to signify to God when he comes back, whether you have been good or not…it's a religious thing"* -Resident
Individual-level concern and superiority	*"A lot of them are white supremacy and feel like they don't have to do anything as to involving wearing a mask or taking their shots."* -Resident (Focus group) *"They live inside their own little bubble. They don't believe, don't really care what the rest of the world is doing. They just care about their situation. "God got us." That's how they think."* - Resident (Focus group)

Table D3. Supportive quotes for reasons for trust and mistrust of COVID-19 vaccine information

2.1.3. Reasons for trust of COVID-19 vaccine information	
Recommended by others	*"Then another thing, where **I get my resource from is my mom because she deals with patients who get COVID vaccines**, COVID, and all that. She works in the medical field, I'm going to listen to people in the medical field because they know their shit."* -Resident (Focus group) *"We sat there talking to the vaccinators and **they duplicated data that I had already collected on my own**…I became **more and more comfortable**. They know what they're talking about. It **went from undecided to, yes, I got it**."* -Resident *"**My ex and her mom are in the medical field**, so they were like, 'Got to get that vaccine.' I was like, 'Yes, you all are kind of right.'…I wouldn't say it made up my decision but they **definitely nudged me to get the COVID vaccine**."* -Resident
Objective	*"Like I said, they'll put both views because someone's missing information, but **they'll try to put as non-biased views as possible**, like, "Here, if you're conservative leaning, read this part. If you're progressive leaning, it's--," or just, "Here's just facts. Just read this up."* -Resident
Honest	*"Later on he said that his information wasn't accurate, it's because they didn't know yet, and **he'd admitted that**, that makes him really show trust. **I can trust him.**"* -Resident
Professional	*"These people have spent their lives dedicated to the research field. I'm going to trust them. **They're putting in that much education and that much skill and time, and putting their lives into that**, that shows a passion for humanity. I'm going to trust them."* -Resident
2.1.4. Reasons for mistrust of COVID-19 vaccine information	
Inconsistent	*'We're not all on the same page. This doctor will say this, and then two minutes later you watch the news and it's something completely different. For instance, not too long ago, they said, "Okay, if you have your shot, it's okay to be out. You don't need a mask, it's okay." Then you got all these people out there, and then, "Oh, nope, **we made a mistake, you should be masking if you haven't had your shot.**"* -Resident (Focus group)
Mishandling	*'There's always more than what they tell you, always more. **We went from we don't have a problem to there is a problem but it's under control. Then control, out of control.** So who you believe?'* -Resident (Focus group)
Money	*'Even news which is supposed to be unbiased and so forth, they're still in the business of making money. By entertaining people is how they make their money. They tell people what they want to hear a lot.'* -Resident

Table D4. Supportive quotes for factors contributing to COVID-19 vaccine access

2.2. **Supportive quotes for factors contributing to COVID-19 vaccine access**	
Cost	*"First of all, it's free. Particularly here in the United States, there are several places where they are offering it, so there's no excuse. I mean, just like with the test, if you want to get vaccinated, there are places you can go. I don't think it's too difficult."* -Resident
Availability	*"There is probably a vaccination center on every street corner...I think that if someone hasn't been vaccinated, especially in this city, in this state, it's because they don't want to, because there are vaccination centers everywhere."* -Resident
Eligibility	*"I had to wait until I was eligible. There was a delay. It had been rolled out for close to three months when we finally managed to get it."* -Resident
Appointments	*"[It] took me three months to get my first dosage because although I could have because I was essential, I couldn't find appointments at all. I found one by accident, I had to drive an hour and a half...I kept refreshing the page for like an hour until something popped up"* -Staff

Table D5. Supportive quotes for incentives and requirements

2.3. Incentives and requirements	
Money	*"There's a lot of things **I could use the money** for, that I really, really could use it for. Then I wouldn't be homeless, for one thing. I know money sounds a bit crass incentive. **It's practical**."* -Resident *"Incentives like **getting a gift card** and stuff, **I definitely would have got [the COVID-19 vaccine] sooner.** It wouldn't necessarily change people's minds, but it would definitely help people be like, "Okay. Let me get the vaccine."* -Resident *"A giveaway by the federal **government, like a lottery** or something, a $1 million prize or something to get a vaccine"* -Resident (Focus group) *"I believe people can be bought. Everything is for sale, everything. If you offer a pile of money, I believe each person, may be different for each person, but you bet if you offer a person an amount of money they will show up. They will take the vaccine for a certain amount of money. I don't know the amount, but **if you offer money to get vaccinated, more people will get vaccinated for sure**."* -Resident (Focus group) "Vaccinations is fairly new. Maybe eight months or they just barely came out with the vaccination. I'm still undecided. I heard they did incentives. If somebody said he would give you $100 to take the- [COVID-19 vaccine] that's where it gets tricky. ***Why would you incent somebody to get this vaccination if it's for their betterment***?"-Resident
Food	*"Krispy Kreme would help here. **You get a free donut if you were vaccinated**. It **helped a lot** more than it should have."* -Resident *"Incentives of a **lunch or a barbeque for everybody** or something like that."* -Resident (Focus group)
Housing, other goods	*"I'll give you a house or a place to stay if you get the vaccine, people will do it. People do not want to be here. You want to go home and you're like, housing, if you took this up, people would jump, **everybody would get vaccinated to have a house**."* -Resident (Focus group) *"I know that Seattle was doing **joints for jabs**. I know **people like free stuff**, so maybe that'll work."* -Resident *"They're giving **beanies, socks**. I know a lot of homeless people were getting [COVID-19 vaccines] not only because they thought it was a good idea but because they were getting something out of it.*" -Resident (Focus group)
Paid time-off work and childcare	*"I think when you get the second vaccine you should receive an automatic get-out-of-everything card, for 36 hours, the time for it to hit because it does take some time to hit and then 24 hours after. you can feed the children Cheetos, get-out-of-everything card"* -Resident
Relief from lockdowns, masking	*"My incentive was **I wanted freedom**. If I get the shot, okay I can go out and do things now and that wasn't the case. I got to shot and I got shut down still….I actually hunted it down and chased it down to get the vaccination and went to find Pioneer Square Clinic and jumped around until **I was able to get the vaccine which it did absolutely no good in releasing us from the lockdown** that they had."* -Resident (Focus group)

Requirement for public-facing jobs, school	*"My son, before they shut the school down for the rest of the year, I **wouldn't have felt comfortable sending him if the staff there wasn't going to get vaccinated**."* -Resident (Focus group) *"If you work in the hospital or a airport or something federal, you **should be vaccinated if you deal with mass public**. If the owner of that business requires you to get vaccinated, then you **need to be vaccinated or find you a different job**."* -Resident (Focus group) *"For my scholarship and to go to my school, yes, i**t was just a requirement**, and I was just an apprentice. I didn't even know it existed until the requirement.*" -Resident
Extra incentives in communal living settings	*"I think like in **communal living situations though it should be stressed.** If you're going to be in close proximity to everyone, like in hospitals, jails, airplanes, homeless shelters, schools, at college, university."* -Resident (Focus group)

CHAPTER 3. HEALTH AND ECONOMIC IMPACT OF COVID-19 SURVEILLANCE TESTING AMONG ADULTS IN KING COUNTY HOMELESS SHELTERS: A COST-EFFECTIVENESS ANALYSIS

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Preface

This Chapter contains a manuscript under review at CDC clearance, in preparation for submission for peer-reviewed publication.

Abstract

Importance: COVID-19 surveillance in congregate living settings is important to mitigating pandemic harms, but the health and economic impact of testing remains unclear.

Objective: To estimate the cost-effectiveness of pandemic COVID-19 surveillance testing in Seattle shelters by vaccination coverage.

Design: We developed an 11-state Markov model to estimate health outcomes and costs and determine the cost-utility of COVID-19 testing strategies in homeless shelters from both the healthcare perspective (including direct medical costs) and limited societal perspective (including direct and indirect costs) over a one-year time horizon.

Setting: 23 homeless shelters in King County, Washington.

Participants: Model inputs utilized data from shelter residents aged ≥18 years who participated in the Seattle Flu Study between 1/1/2020–5/31/2021.

Interventions: We compared no in-shelter surveillance to two COVID-19 testing strategies implemented once per month in each shelter: 1) polymerase chain reaction (PCR) testing, or 2) rapid antigen (Ag) testing.

Main Outcomes and Measures: The primary health outcome was quality-adjusted life-years (QALYs). Costs (2023 USD) were estimated from standardized sources, literature review, and expert opinion. We considered an intervention cost-effective if the incremental cost-effectiveness ratio (ICER) was ≤$150,000/QALY and dominant if it saved costs and provided health effects.

Results: We found the majority of rapid Ag testing scenarios were cost-effective, while PCR testing was dominated by (i.e., less effective and more costly than) Ag testing.

Compared with no in-shelter surveillance, Ag testing increased mean QALYs by 0.0009 (0.03% infections averted), at an incremental cost of $97.42 per shelter resident from the healthcare payer perspective (ICER: $112,352/QALY gained) and $8.35 per shelter resident from the societal perspective (ICER: $9,627/QALY gained) at 75% vaccination coverage. PCR testing was cost-effective compared to no surveillance when vaccination coverage was <30% from the healthcare perspective and ≤48% from the societal perspective. Probabilistic sensitivity analysis showed Ag testing was cost-effective in 62% and 86% of simulations from the payer and societal perspectives, respectively.

Conclusions and Relevance: Modeled findings show that COVID-19 testing in shelters can be a cost-effective pandemic response. Rapid Ag testing remained cost-effective at high vaccination levels, while PCR testing was most effective at low vaccination levels.

Background

The coronavirus disease 2019 (COVID-19) pandemic has caused enormous morbidity and mortality, and has had disparate impacts across socioeconomic and racial groups in the United States (US).[135,136] Among people experiencing homelessness, the risk of death from COVID-19 has been estimated to be 30-50% higher than the overall population.[15,137] Of an estimated 582,462 people experiencing homelessness each evening in the US, approximately two-thirds (60%) reside in homeless shelters.[138] Ensuring the inclusion of shelters in surveillance efforts is paramount, as people experiencing sheltered homelessness face an increased risk for respiratory viral infections due to the challenges of maintaining physical distance.[12,36,55,56] Therefore, surveillance of COVID-19 incidence and vaccination, particularly in congregate settings and among marginalized populations, is important to mitigating pandemic harms.

A community-based surveillance study of COVID-19 cases in Seattle homeless shelters found an unmet need for routine SARS-CoV-2 testing outside of clinical settings for people experiencing homelessness in order to identify outbreaks and prevent further transmission.[22,23] Increasing access to SARS-CoV-2 testing and enhancing mitigation strategies for COVID-19 among people experiencing homelessness is a public health priority. However, little is known about the health impact and economic impact of COVID-19 surveillance testing and vaccination programs in homeless shelters.

We aimed to estimate the health and economic impact of pandemic COVID-19 surveillance testing for adults across Seattle King County shelters. Findings may

support recommendations for COVID-19 and future outbreak mitigation for key stakeholders, including shelters, public health, and policymakers.

Methods

We developed a Markov model to estimate health outcomes and costs and determine the cost-utility of monthly COVID-19 surveillance testing strategies in homeless shelters. This economic evaluation was the second step in an analysis plan, which was shaped in part by a preliminary decision tree analysis (see Supplemental Figure 3.1). This study followed the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) reporting guideline.[139]

Scenarios

We compared a baseline scenario consisting of no in-shelter testing to two alternative scenarios in which shelter management actively encouraged all residents to participate in SARS-CoV-2 testing 1x/month regardless of symptoms with either: scenario 1) polymerase chain reaction (PCR) testing, or scenario 2) rapid antigen (Ag) testing. We modeled monthly testing as this was the most realistic testing frequency among shelter residents in the Seattle Flu Study (SFS). While testing frequency varied throughout the pandemic and changed based on individual preference— and select individuals opted for more frequent testing (which may be more ideal)— monthly testing was more commonly observed. Both PCR and Ag tests had a different sensitivity and specificity for those who were symptomatic versus asymptomatic. These represent different testing

strategies employed over the study period and potential interventions that could be adopted more widely, such as in other congregate living facilities.

Model

Figure 1 depicts the 11-state Excel-based Markov model used to compare the two intervention strategies (i.e., monthly PCR or Ag surveillance testing) to no intervention (i.e., no surveillance testing). We assumed that at the start of the model time horizon, the population was in one of two uninfected, not hospitalized states— one which represents individuals vaccinated against COVID-19 (≥ 1 dose in the past year) and the second representing individuals unvaccinated against COVID-19. We assumed that vaccination coverage remained constant for the duration of the time horizon, with 75% of the population ≥1 dose and 25% had 0 doses of COVID-19 vaccine in the past year. Additionally, all transition probabilities were differentiated by vaccination status.

At each time step, those who were uninfected faced a probability of becoming infected and not hospitalized, infected and hospitalized, or remaining uninfected. Those who were infected and hospitalized remained in a tunnel state for two time-steps and experienced a probability of dying or returning to the uninfected state after ≥3 months. All infected and not hospitalized individuals in the model returned to the uninfected state after ≥3 months.

Across scenarios the model assumed a proportion of the shelter population was either symptomatic or asymptomatic and test sensitivity and specificity was based on type of

test used as demonstrated in nested decision tree for each Markov state besides death (Table 3.1, Figure 3.1). All hospitalized COVID-19 cases were assumed to be symptomatic and remain symptomatic for two time-steps. Test performance impacted a shelter residents' likelihood of testing positive or negative for COVID-19, and thus whether or not they were placed in isolation (e.g., put in a separate room or moved to an isolation and quarantine facility). To account for the differences in PCR versus Ag testing scenarios and reduced transmission due to isolation, we multiplied each probability of infection by (1- the proportion isolated in the previous cycle) as a proxy to incorporate dynamic incidence in the model.

We considered an intervention to be cost-effective if the incremental cost-effectiveness ratio (ICER) was ≤$150,000/QALY and economically dominant if it saved costs and provided health effects (i.e., cost saving).[140–142] The one-year time horizon did not account for premature mortality or lifetime productivity losses. Additionally, we assumed that COVID-19 health impacts did not extend past a one-year time horizon. We also assumed voluntary participation in surveillance interventions. We did not include children aged <18 years or shelter staff in this analysis.

Results are presented from both a healthcare payer and limited societal perspective. The healthcare payer perspective includes direct medical costs (e.g., testing, outpatient care, hospitalization), while the limited societal perspective additionally includes both direct and indirect costs outside the healthcare sector (e.g., productivity losses related to absenteeism resulting from COVID-19, out-of-pocket costs for over-the-counter

medication). This could inform government and health department decisions and broader policy implications about costs and benefits to society as a whole. Intervention start-up costs (e.g., research and development of intervention materials) were excluded so that all interventions were evaluated and compared as if operating under steady-state conditions. Costs and outcomes were modeled over a one-year time horizon with a monthly time cycle. Given the short one-year time horizon, we did not discount health outcomes or costs.

Study population, setting and location

We aimed to model homeless shelter residents in King County, Washington. Population and symptom characteristics were parameterized using input data from the SFS population ≥18 years (Table 3.1, Supplemental Figure 3.2, Supplemental Table 3.1). More details about the SFS methods are published elsewhere.[22,23,53,72] In brief, the study included residents from 23 shelters including adult mixed gender, adult male only, adult female only, family, and young adult (i.e., residents 18-25 years) shelters. The median age of residents was 37 years, of whom a majority self-identified as male (64%), 46% experienced chronic homelessness (duration ≥1 year), and 17.5% were employed.[53] Ethics approval for the SFS was obtained from the University of Washington Human Subjects Division (STUDY00007800). As this analysis used only aggregate, published data, no additional institutional review board review was required.

Costs

Costs were estimated using standardized sources, literature review, and expert opinion (Table 3.1). For example, over the counter medications costs were estimated *via* Walgreens Price Listing[143] and hospitalization costs were obtained from US Department of Health & Human Services Healthcare Cost and Utilization Project (HCUP) based on International Classification of Diseases, Tenth Revision, Clinical Modification (ICD10) codes.[144] Productivity losses due to absenteeism from work for COVID-19 illness or death were estimated using the median annual national occupational wage from the Bureau of Labor Statistics. We used market wages as opposed to non-market wages for people of all ages to expressly value the time all shelter residents (regardless of employment status), in order not to be discriminatory.[145] All costs were reported in 2023 US dollars (USD), converting all costs using the Consumer Price Index inflator.[146]

Outcomes

Health outcomes were measured in quality-adjusted life-years (QALYs) which encompass both morbidity and mortality (i.e., the length and quality of life) into a single measure of health benefit. Healthy utility weights (representing a value 0 to 1 on the spectrum between death and perfect health)[150] were lower for the proportion of residents aged ≥65 years and with underlying medical conditions. Each COVID-19 case lost QALY values based on age-dependent healthy QALY values and infection-specific utility weights for the number of days in each state, including symptomatic (vs. asymptomatic) illness, hospitalization (vs. no hospitalization), and death (vs. live). While our study population was unique in certain characteristics (e.g., underlying medical

conditions) and utility may deviate from the general population, we used standardized sources that most closely represent standard utility for adults in the US.[147–149]

Sensitivity analyses

We assessed parameter uncertainty through deterministic one-way sensitivity analyses for each scenario and perspective. In addition, for each test type and perspective, we characterized parameter uncertainty by performing both lower bound and upper bound scenario analyses that take into account the ten most influential parameters leading to a decreased (i.e., lower bound, optimistic) ICER or an increased (i.e., upper bound, pessimistic) ICER (Supplemental Table 3.2). For example, the upper bound pessimistic scenario analysis for Ag testing from the payer perspective uses high vaccine coverage, high test specificity, and minimal difference in utility between those who were symptomatic versus asymptomatic.

Lastly, we conducted a probabilistic sensitivity analysis by varying all inputs across their range in 5,000 simulations to generate 95% credible range. We plotted cost-effectiveness acceptability curves to show the probability of each testing intervention being cost-effective at different willingness-to-pay thresholds and under different perspectives.

Engagement approach

Partnerships with local shelter management and public health leaders were established prior to the COVID-19 pandemic, allowing for community engagement and input

throughout the research process. During data collection as part of the SFS, we had regular check-ins with shelter staff, allowing for the incorporation of resident and staff feedback and quick dissemination of findings to inform real-time decision-making locally. Findings from this analysis will be shared through community networks with the goal of creating a more effective and equitable response to the COVID-19 pandemic among people experiencing homelessness. Furthermore, the evidence gathered through this analysis may be translated to plan for future pandemic preparedness and resource allocation.

Results

Study parameters

Table 3.1 displays key model inputs including costs, QALY estimates, and transition probabilities. Where possible, we used primary data from the SFS, which was specific to homeless shelter residents in King County. Data were supplemented from published studies on COVID-19, and previous models evaluating COVID-19 testing strategies in the US (Supplemental Table 3.3).

The estimated cost of PCR and Ag tests were $19.56 (range: $17.60-$21.52) and $5.50 (range $4.52-$6.48), respectively. Operational costs of PCR testing ($18.66; range $16.70-$20.62) were also greater than Ag testing ($4.98; range $4.00-$5.96) due to the need to transport and process specimens and return results.[151–153] Utility weights for health QALY estimates were age-specific, with 0.92 for those 18-64 years old, and 0.84 for those ≥65 years old.[147] Influenza without hospitalization was used as a proxy for

utility weight of mild non-specific COVID-19 symptoms (0.648),[154–158] whereas influenza with hospitalization will be used as a proxy for utility weight of hospitalized, non-pneumonia COVID-19 (0.514).[156,158,159]

All transition probabilities were estimated from data during the Omicron phase of the COVID-19 pandemic in the US, stratified by COVID-19 vaccination status.[160,161] Transition probabilities from uninfected to infected states were King County specific and adjusted for the proportion and 95% uncertainty interval of cases or hospitalizations reported.[161,162] The proportion estimated to be symptomatic in each state was derived from previously published SFS data on self-reported symptoms among shelter residents.[24,53]

Baseline results

Table 3.2 summarizes the results comparing PCR testing vs. no surveillance and Ag testing vs. no surveillance from both the healthcare payer and societal perspectives. The majority of rapid Ag testing scenarios were cost-effective, while PCR testing was dominated by (i.e., less effective and more costly than) Ag testing.

At a 75% vaccination coverage, compared with no in-shelter surveillance, PCR testing averted 0.028% infections and increased mean QALYs by 0.0009 (95% credible range: 0.0001, 0.0024), at an incremental cost of $386 ($327, $444) per shelter resident from the healthcare payer perspective and $303 ($144, $422) per shelter resident from the societal perspective. PCR testing was not cost-effective from either perspective

compared to no surveillance at 75% vaccination coverage (payer perspective: ICER of $433,441/QALY gained; societal perspective: ICER of $340,184/QALY gained). However, PCR testing was cost-effective compared to no surveillance when vaccination coverage was <30% from the healthcare perspective and ≤48% from the societal perspective (Figure 3.2.a, Supplemental Figure 3.3.a-b).

Ag testing was cost-effective compared to no surveillance from both the healthcare payer perspective (ICER: $112,352/QALY gained) and the societal perspective (ICER: $9,627/QALY gained) at 75% vaccination coverage. When comparing Ag testing to no surveillance at 75% vaccination coverage, 0.028% of infections were averted with mean QALYs increasing by 0.0009 (0.0001, 0.0022), but at an incremental cost of $97.42 and $8.35 per shelter resident from the healthcare payer and societal perspectives, respectively. At ≤70% vaccination coverage, Ag testing was cost-saving compared to no surveillance from the societal perspective (Figure 3.2.a, Supplemental Figure 3.3.a-b).

Sensitivity analyses

Figure 3.2.b illustrates results from probabilistic sensitivity analyses. We found that PCR testing was cost-effective in 2% and 11% of simulations from the payer and societal perspectives, respectively. However, Ag testing was cost-effective in 62% and 86% of simulations from the payer and societal perspectives, respectively.

Tornado diagrams of one-way sensitivity analyses for PCR testing compared to no surveillance and Ag compared to no surveillance are presented in Figures 3.3.a-d. In

both scenarios from the healthcare payer perspective, the ICER was most sensitive to uncertainty in the proportion vaccinated, utility weights, test specificity, and test cost (Figure 3.3.a-b). From the societal perspective, uncertainty in the daily wage, proportion screened, and proportion symptomatic among infected and non-hospitalized individuals had a large impact on the ICER (Figure 3.3.c-d).

Upper bound, pessimistic scenario analyses showed that ICERs for all test types and perspectives have potential to surpass the $150,000 threshold and become no longer cost-effective. However, for both PCR and Ag tests, lower bound optimistic scenario analyses illustrate the ICERs from the payer perspective can be cost-effective, while ICERs from the societal perspective can be cost-saving. See Supplemental Table 3.4 for details.

Discussion

We estimated the health and economic impact of pandemic COVID-19 surveillance testing across King County shelters, finding that the majority of surveillance scenarios using rapid Ag testing were cost-effective from both the healthcare payer and societal perspectives. However, PCR testing was only cost-effective compared to no surveillance at lower vaccination coverage levels. Parameters with the greatest impact on model results included the proportion of the population vaccinated, utility weights, test specificity, and daily wage. Obtaining and utilizing the most precise and timely estimates for these parameters is crucial to limit uncertainty in future research. Our modeled findings can inform public health agency decisions and broader policy

implications about costs and benefits of COVID-19 pandemic surveillance to society as a whole.

Previous studies modeling different testing strategies have focused on cost-effectiveness prior to COVID-19 vaccination availability and mostly found that surveillance was cost-effective or cost-saving (Supplemental Table 3.3).[151,163–171] For example, Maya et al. found that Ag testing had the potential to be dominant (cheaper and more effective) over PCR-only in a population of healthcare workers in the US.[164] Supplemental Table 3.3 summarizes published, peer-reviewed cost-effectiveness analyses (CEAs) evaluating various SARS-CoV-2 testing strategies in US settings. These economic evaluations were identified based on a systematic review by *Zhou et al. 2022*,[172] and supplemented with additional manuscripts from an updated search of articles published since July 2023. Of the 10 analyses, three used a decision tree model,[151,163,164] five utilized a compartmental model,[165–169] and two used a stochastic agent-based model.[170,171] The median time horizon reported was 136 days, ranging from 60-270 days. The majority of analyses used ICERs to evaluate cost-effectiveness. Our model utilizes a Markov model enabling us to evaluate the impact of repeat testing, and repeat infection, as well as dynamic incidence to account for reduced transmission due to isolation.

Our study adds to the minimal data available to quantify the potential value of in-shelter PCR or Ag surveillance for SARS-Cov-2 among adults experiencing homelessness and how this value may change depending on the type of test used. Findings can be used

by shelter management and public health jurisdictions to inform implementation of COVID-19 surveillance testing. These results may also be applicable to shelter settings or similar congregate living settings (e.g., prisons or border detention centers) in current pandemic response and potentially in future seasonal epidemics .[7,10,11] Additionally, this model could serve as a foundation for simulating other respiratory viruses outbreak scenarios by updating input parameters such as transmission probabilities, disease severity, test characteristics, and costs. This economic evaluation can help stakeholders prioritize which interventions have the best value for money to implement to protect this higher-risk population.

This analysis had several strengths and limitations. First, this is a novel cost-utility analysis comparing PCR and Ag SARS-CoV-2 testing strategies among people experiencing sheltered homelessness during the COVID-19 pandemic. Estimates of cost-effectiveness are conservative as the Markov model does not include herd immunity and only crudely incorporates transmission dynamics by adjusting transition probabilities based on the proportion of individuals isolated. Additionally, the one-year time horizon does not account for premature mortality or lifetime productivity losses, which may increasingly be important as understanding of COVID-19 disease progression and long COVID evolves and more data is collected. This was also considered to be conservative as over a longer time horizon, screening would likely lead to decreased costs and increased utility from averting COVID-19 cases, which would also avert long COVID. While this leads to likely underestimated estimates of cost-effectiveness, these important limitations are critical to account for in future analyses.

We suggest that future models incorporate transmission using a compartmental or agent-based model. Subgroup analysis will also be an important part of future analyses to understand differences between key subgroups (e.g., types of shelters, children vs. adults, staff vs. residents). Additionally, as the COVID-19 landscape and data continue to evolve, this analysis should be revisited with updated parameters, in particular those with greatest influence where there is large uncertainty such as the proportion vaccinated, test cost, and test performance. Comprehensive reporting of updated sensitivity analysis results will allow decision-makers to assess the validity of the model, as well as guide future data collection to obtain more precise parameter estimates.[173]

Conclusion

These findings emphasize that rapid Ag testing for COVID-19 in congregate settings is likely to be cost-effective, while PCR testing may be optimal at low vaccination coverage levels. As COVID-19 continues to have a devastating impact globally, our study can help decision-makers in shelter populations and other congregate settings understand and develop novel recommendations for surveillance implementation to reduce morbidity and mortality.

Tables and Figures

Table 3.1. Model inputs

Parameters	Mean or Median	Standard Error or Range	Distribution	Source
Costs (2023 USD)				
SARS-CoV-2 PCR test	$19.56	$17.60 - $21.52	Normal	SFS expert opinion[153]
Operational cost per SARS-CoV-2 PCR test	$18.66	$16.70 - $20.62	Normal	SFS expert opinion[153]
SARS-CoV-2 Rapid Ag test	$5.50	$4.52 - $6.48	Normal	SFS expert opinion[153]
Operational cost per SARS-CoV-2 Ag test	$4.98	$4.00 - $5.96	Normal	SFS expert opinion[153]
Over the counter medications, daily [a]	$0.54	$0.15 - $0.93	Gamma	Bartsch et al. 2021[148]
Outpatient care, daily [b]	$152.54	$130.20 - $174.88	Normal	CMS[174]
Hospitalization non-ICU, daily	$1,804.27	$1,196.79 - $2,411.75	Normal	US Dept of HHS[144,148]
Hospitalization ICU, daily	$6,867.27	$6,066.88 - $7,667.66	Normal	US Dept of HHS[144,148]
Annual wages (all occupations)	$52,376.61	$30,921.54 - $124,737.99	Normal	Bureau of Labor Statistics[175]
Utility weights				
Healthy QALY, 18-64 years	0.92	0.04	Normal	Gold et al. 1998[147]
Healthy QALY, ≥65 years	0.84	0.04	Normal	Gold et al. 1998[147]
Mild non-specific symptoms [c]	0.65	0.10	Beta	Bartsch et al. 2021[148]
Hospitalized, non-pneumonia symptoms [d]	0.51	0.09	Beta	Bartsch et al. 2021[148]
Acute respiratory distress syndrome (ARDS) [e]	0.10	0.08 - 0.15	Normal	Wu et al. 2018[149]
Disease duration				
Symptomatic days	9.00	8.61 - 9.39	Normal	Menni et al. 2022[182]
Isolation days	5.00	4.61 - 5.39	Normal	Du et al. 2022[171]
Hospitalization days, vaccinated	4.30	4.20 - 4.40	Normal	Havers et al. 2022[176]
Hospitalization days, unvaccinated	4.60	4.50 - 4.70	Normal	Havers et al. 2022[176]

Parameters	Mean or Median	Standard Error or Range	Distribution	Source
Death days	300.00	241.20 - 358.80	Normal	Assumed
Transition probabilities				
Vax-Uninf-NotHosp to Vax-Uninf-NotHosp	0.9843	0.9833 - 0.9851	-	Assumed
Vax-Uninf-NotHosp to Vax-Inf-Hosp	0.0003	0.0003 - 0.0004	Beta	King County 2023[161]
Vax-Uninf-NotHosp to Vax-Inf-NotHosp	0.0154	0.0146 - 0.0163	Beta	King County 2023[161]
Vax-PostInf-Hosp to Vax-Uninf-NotHosp	0.9217	0.9021 - 0.9413	Normal	Assumed
Vax-PostInf-Hosp to Death	0.0783	0.0587 - 0.0979	Normal	Danza et al. 2022[160]
Unvax-Uninf-NotHosp to Unvax-Uninf-NotHosp	0.9565	0.9533 - 0.9589	-	Assumed
Unvax-Uninf-NotHosp to Unvax-Inf-NotHosp	0.0370	0.0352 - 0.0393	Beta	King County 2023[161]
Unvax-Uninf-NotHosp to Unvax-Inf-Hosp	0.0065	0.0059 - 0.0075	Beta	King County 2023[161]
Unvax-PostInf-Hosp to Unvax-Uninf-NotHosp	0.8784	0.8588 - 0.8980	Normal	Assumed
Unvax-PostInf-Hosp to Death	0.1216	0.1020 - 0.1412	Normal	Danza et al. 2022[160]
Population parameters				
% vaccinated	0.75	0.20 - 0.90	Normal	Assumed
% age 18-64	0.92	-	-	Rogers et al. 2023[53]
% age 65+	0.08	-	-	Rogers et al. 2023[53]
Characteristics of care seeking and care				
% screened: PCR Testing	0.80	0.70 - 0.90	Normal	Assumed
% screened: Ag Testing	0.80	0.70 - 0.90	Normal	Assumed
% symptomatic				
Vax-Uninf-NotHosp	0.15	0.11 - 0.19	Normal	Rogers et al. 2023[53]
Vax-Inf-Hosp	1.00	0.95 - 1.00	-	Assumed
Vax-Inf-NotHosp	0.60	0.52 - 0.68	Normal	Cox et al. 2023[24]
Vax-PostInf-Hosp	1.00	0.95 - 1.00	-	Assumed
Vax-PostInf-NotHosp	0.30	0.24 - 0.36	Normal	Cox et al. 2023[24]
Unvax-Uninf-NotHosp	0.15	0.11 - 0.19	Normal	Rogers et al. 2023[53]
Unvax-Inf-NotHosp	0.70	0.62 - 0.78	Normal	Cox et al. 2023[24]

Parameters	Mean or Median	Standard Error or Range	Distribution	Source
Unvax-Inf-Hosp	1.00	0.95 - 1.00	-	Assumed
Unvax-PostInf-NotHosp	0.35	0.29 - 0.41	Normal	Cox et al. 2023[24]
Unvax-PostInf-Hosp	1.00	0.95 - 1.00	-	Assumed
% seeking outpatient care if symptomatic	0.33	0.29 - 0.37		Cox et al. 2023[24]
% in ICU				
Vaccinated	0.20	0.18 - 0.21	Normal	Havers et al. 2022[176]
Unvaccinated	0.22	0.20 - 0.24	Normal	Havers et al. 2022[176]
Test performance				
PCR Sensitivity Asymptomatic	0.80	0.78 - 0.82	Normal	Srivatsan et al. 2022[177]
PCR Sensitivity Symptomatic	0.90	0.88 - 0.92	Normal	Kortela et al. 2021[178]
PCR Specificity Asymptomatic	1.00	0.99 - 1.00	Beta	Skittrall et al. 2021[179]
PCR Specificity Symptomatic	0.99	0.98 - 1.00	Beta	Srivatsan et al. 2022[177]
Ag Sensitivity Asymptomatic	0.28	0.21 - 0.34	Normal	Venekamp et al. 2023[180]
Ag Sensitivity Symptomatic	0.79	0.75 - 0.83	Normal	Schuit et al. 2022[181]
Ag Specificity Asymptomatic	1.00	0.99 - 1.00	Beta	Venekamp et al. 2023[180]
Ag Specificity Symptomatic	0.97	0.92 - 1.00	Beta	Schuit et al. 2022[181]

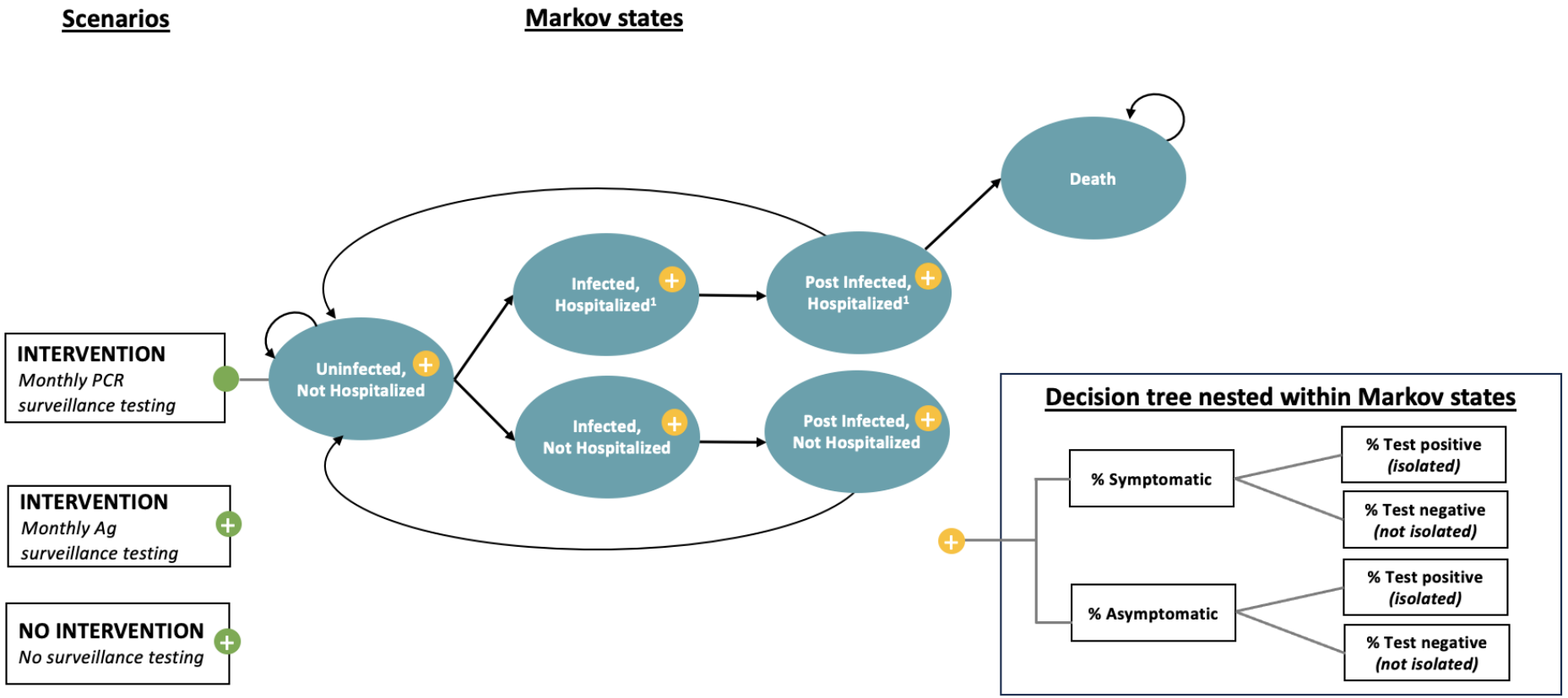
[a] Mild COVID-19 symptoms; assumes 200 mg of ibuprofen or acetaminophen orally every 4 to 6 hours as needed
[b] Moderate COVID-19 symptoms
[c] Uses influenza without hospitalization as a proxy
[d] Uses influenza with hospitalization as a proxy
[e] ARDS assumes required ventilator use in intensive care unit (ICU)
NOTE: While our study population is unique and utility may deviate from the general population, these sources most closely represent standard utility for adults in the US

Table 3.2. Effectiveness and cost-effectiveness of expanded COVID-19 surveillance strategies by vaccination coverage

Testing scenario		Incremental Cost (2023 USD)	Incremental Effectiveness (QALYs gained)	ICER ($/QALY gained)
Healthcare payer perspective				
1. No surveillance		Ref	Ref	Ref
2. PCR testing*	**75% vaccination coverage**	**$386**	**0.00089**	**$433,441**
	20% vaccination coverage	$367	0.00292	$125,651
	90% vaccination coverage	$389	0.00053	$737,038
	95% credible range	($327, $444)	(0.00012, 0.00244)	($153,046, $3,195,660)
3. Ag testing^	**75% vaccination coverage**	**$97**	**0.00087**	**$112,351**
	20% vaccination coverage	$80	0.00266	$30,196
	90% vaccination coverage	$101	0.00053	$189,913
	95% credible range	*($767, $119)*	*(0.00012, 0.00228)*	*($37,149, $817,144)*
Limited societal perspective				
1. No surveillance		Ref	Ref	Ref
2. PCR testing*	**75% vaccination coverage**	**$303**	**0.00089**	**$340,183.94**
	20% vaccination coverage	$210	0.00292	$72,081.42
	90% vaccination coverage	$325	0.00053	$615,878.90
	95% credible range	*($144, $422)*	*(0.00012, 0.00244)*	*($84,331, $2,767,971)*
3. Ag testing^	**75% vaccination coverage**	**$8**	**0.00087**	**$9,627**
	20% vaccination coverage	-$104	0.00266	Dominant
	90% vaccination coverage	$37	0.00053	$69,575
	95% credible range	*(-$171, $129)*	*(0.00012, 0.00228)*	*(Dominant, $520,425)*

* PCR testing compared to no surveillance
^ Ag testing compared to no surveillance
95% credible range calculated by computing the 2.5th and 97.5th percentiles across the 5,000 model simulation runs in probabilistic sensitivity analyses

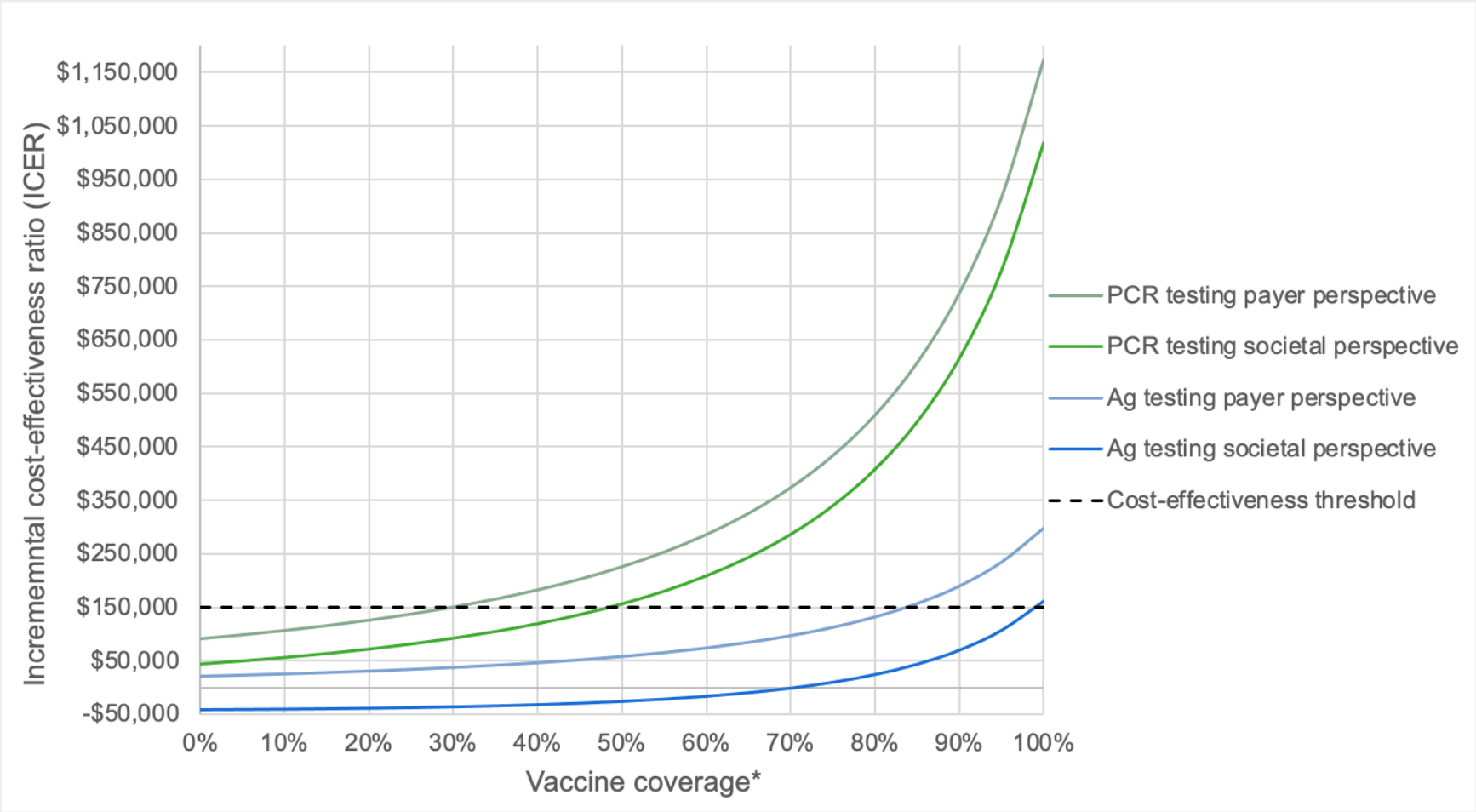
Figure 3.1. Markov model to estimate health outcomes and costs and determine the cost-utility of monthly surveillance testing strategies in homeless shelters*



* All Markov states except death were repeated for vaccinated and unvaccinated proportions of the population (leading to 11 distinct Markov states). At each time step, those who were uninfected faced a probability of becoming infected and not hospitalized, infected and hospitalized, or remaining uninfected. Hospitalized represents COVID-19 hospitalizations only (Not Hospitalized represents COVID-19 non-hospitalizations only). Those who were infected and hospitalized remained in a tunnel state for two time-steps and experienced a probability of dying or returning to the uninfected state after ≥3 months. All infected and not hospitalized individuals in the model returned to the uninfected state after ≥3 months. As demonstrated in nested decision trees (represented by yellow circles), all scenarios across the model assumed a

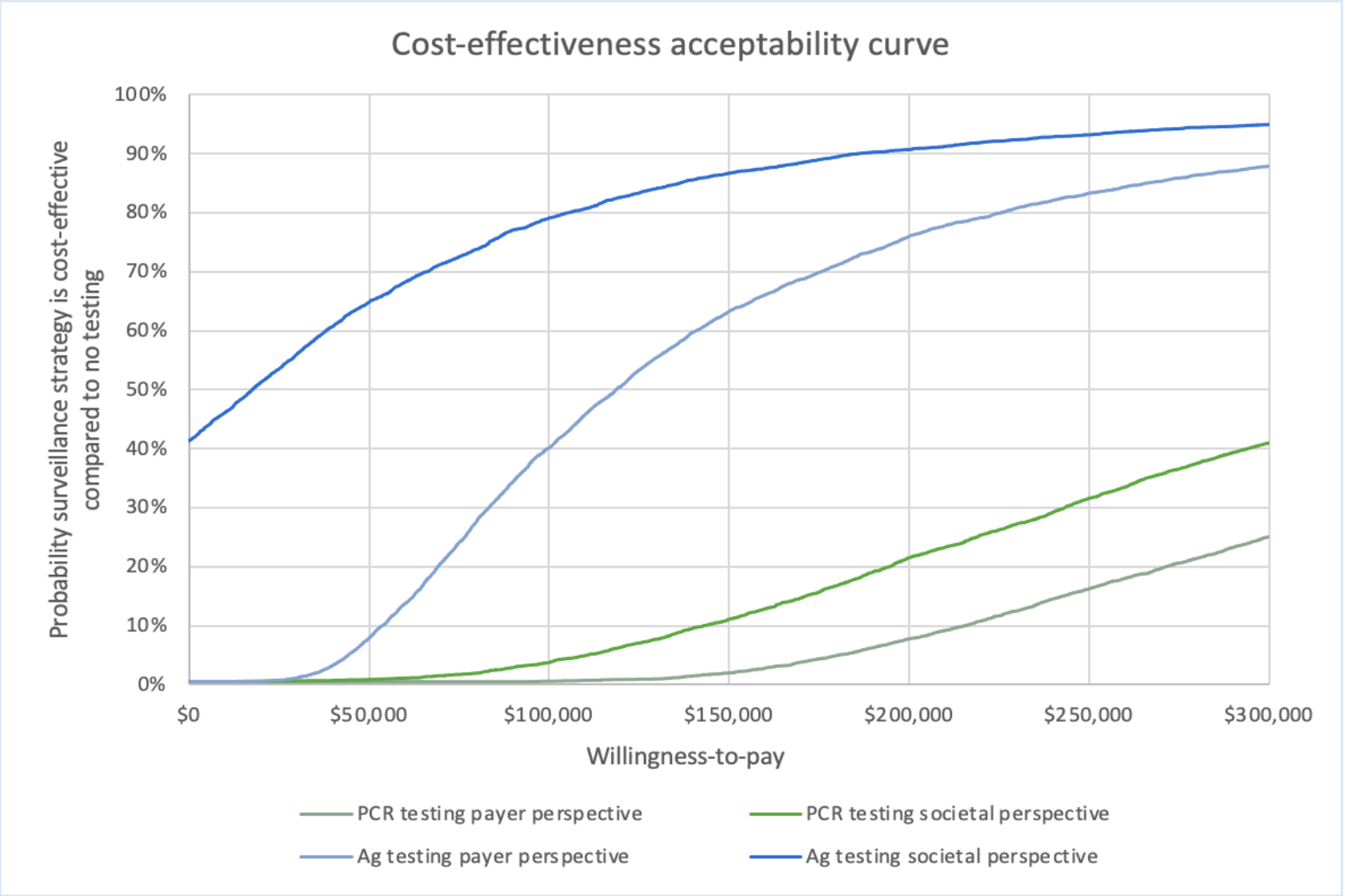
proportion of the shelter population was either symptomatic or asymptomatic and test sensitivity and specificity was based on type of test used. All hospitalized COVID-19 cases were assumed to be symptomatic and remain symptomatic for two time-steps. Test performance impacted a shelter residents' likelihood of testing positive or negative for COVID-19, and thus whether or not they were placed in isolation (e.g., put in a separate room or moved to an isolation and quarantine facility). To account for the differences in PCR versus Ag testing scenarios and reduced transmission due to isolation, we multiplied each probability of infection by (1 minus the proportion isolated in the previous cycle) as a proxy to incorporate dynamic incidence in the model.

Figure 3.2.a. Incremental cost-effectiveness ratios by vaccine coverage, test type, and perspective



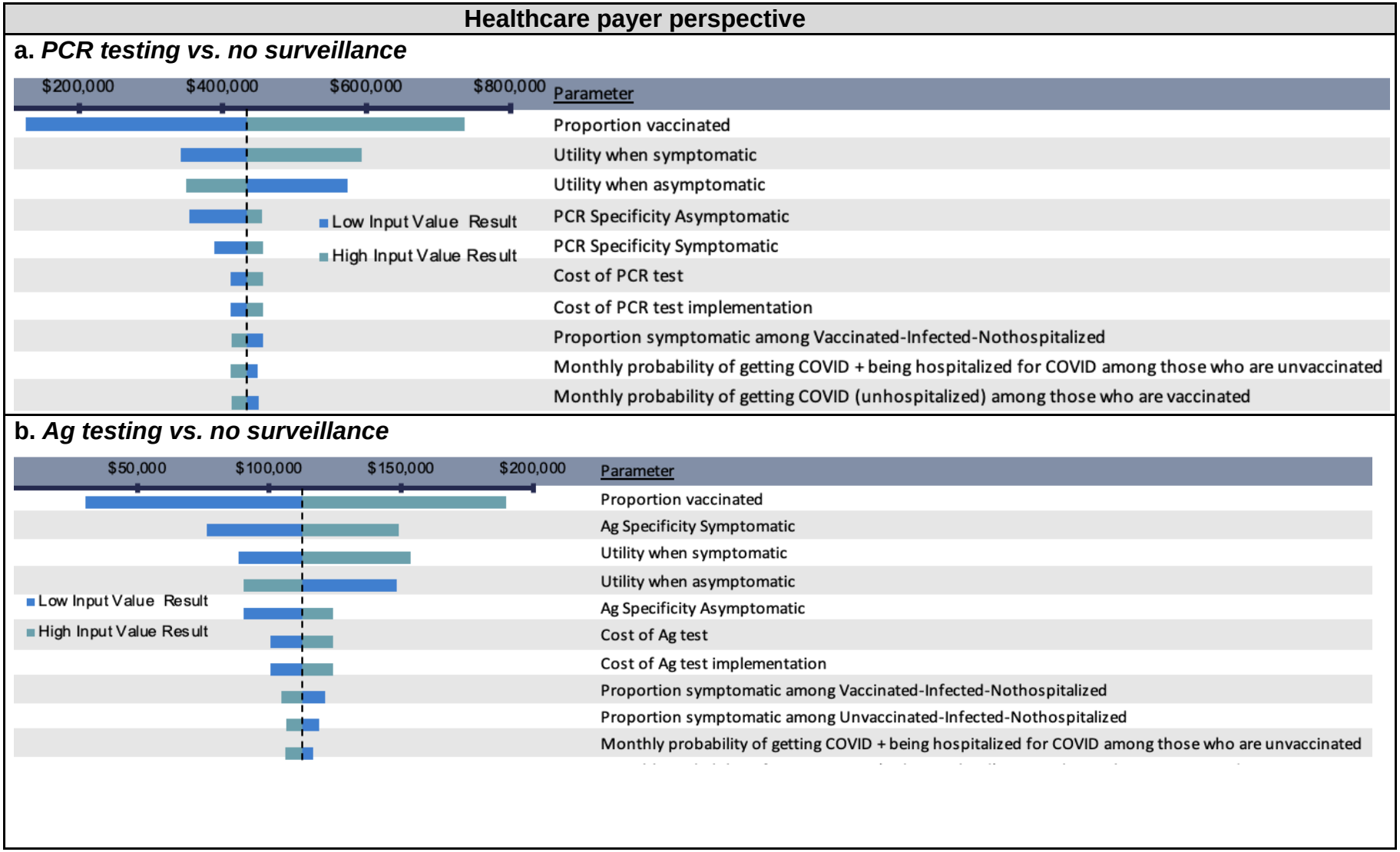
*Vaccine coverage represents the proportion of the population with at least one dose of COVID-19 vaccine

Figure 3.2.b. Cost-effectiveness acceptability curve by COVID-19 surveillance strategy



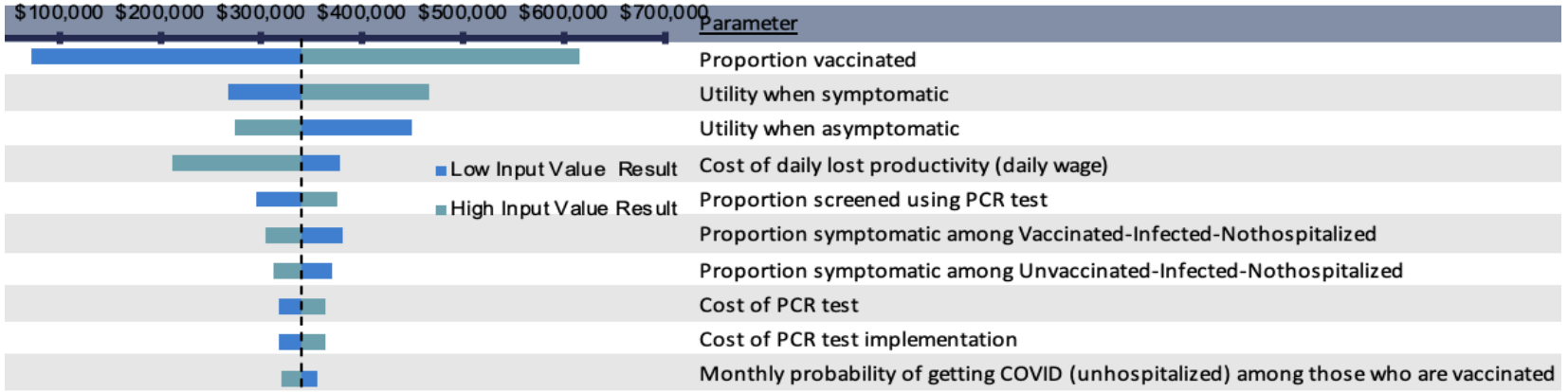
*

Figure 3.3.a-d. Tornado Diagram: one-way sensitivity analyses on the incremental cost-effectiveness ratios (ICERs) of polymerase chain reaction (PCR) testing and antigen (Ag) testing compared to no surveillance by perspective

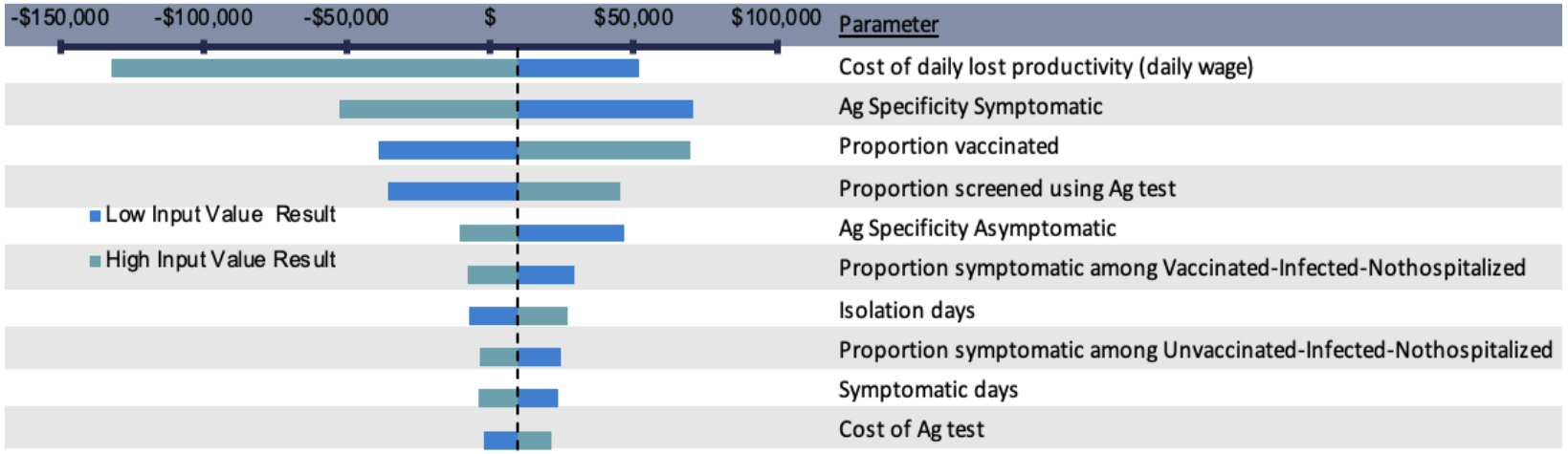


Limited societal perspective

c. *PCR testing vs. no surveillance*



d. *Ag testing vs. no surveillance*



Appendix Materials

Supplemental Table 3.1. Seattle Flu Study shelter sites where sample collection occurred, 1 January 2020 – 31 May 2021

Shelter	Maximum capacity	Resident sex	Resident age range	Sleeping arrangements available
A	60	Female	≥ 18 years	Communal bunk beds
B	100	Mixed	≥ 18 years	Communal bunk beds
C	45	Mixed	18 - 25 years	Communal floor mats and bunks beds
D	185	Mixed	All ages [+]	Private rooms / shared rooms / communal floor mats
E	70	Mixed	All ages [+]	Private rooms / shared rooms / communal floor mats
F	60	Male	≥ 18 years	Communal bunk beds
G	275	Mixed	≥ 18 years	Private rooms / shared rooms
H	275	Mixed	All ages [+]	Private rooms / shared rooms
I	45	Male	≥ 50 years	5 person dorms
J*	34	Male	≥ 18 years	Individual open cubicles
K**	75	Mixed	≥ 18 years	Individual open cubicles
L	200	Mixed	≥ 18 years	Communal bunk beds
M	212	Male	≥ 50 years	Communal floor mats
N	46	Mixed	All ages [+]	Private rooms / shared rooms
O	100	Mixed	All ages[+]	Private rooms / shared rooms / communal floor mats
P	100	Male	≥ 50 years	Communal floor mats
Q	100	Mixed	≥ 18 years	Private apartments
R	150	Mixed	≥ 18 years	Communal floor mats
S	234	Mixed	≥ 18 years	Private apartments
T	49	Male	≥ 50 years	Communal floor mats
U	50	Mixed	All ages[+]	Private rooms / shared rooms / communal floor mats
V	18	Mixed	< 18 years	Communal bunk beds
W	20	Mixed	18 - 25 years	Communal bunk beds

[+]All ages= family shelter

[*]*Opened / data collection began 3 December 2020 to replace Shelter F*

[**] *Opened / data collection began 3 December 2020 to replace Shelter B*

Supplemental Table 3.2. Model inputs for scenario sensitivity analyses

	Top 10 most influential parameters	Lower bound input (optimistic ICER)	Upper bound input (pessimistic ICER)
Scenario analysis 1: PCR payer		***1a lower bound***	***1b upper bound***
1	Proportion vaccinated	0.20	0.90
2	Utility when symptomatic	0.55	0.75
3	Utility when asymptomatic	0.99	0.84
4	PCR Specificity Asymptomatic	0.99	1.00
5	PCR Specificity Symptomatic	0.98	1.00
6	Cost of PCR test	$17.60	$21.52
7	Cost of PCR test implementation	$16.70	$20.62
8	Proportion symptomatic among Vax-Inf-Nothosp	0.6784	0.5216
9	Monthly probability of getting COVID + being hospitalized for COVID among those who were unvaccinated	0.00745	0.00586
10	Monthly probability of getting COVID (unhospitalized) among those who were vaccinated	0.02	0.01
Scenario analysis 2: PCR societal		***2a lower bound***	***2b upper bound***
1	Proportion vaccinated	0.20	0.90
2	Utility when symptomatic	0.55	0.75
3	Utility when asymptomatic	0.99	0.84
4	Cost of daily lost productivity (daily wage)	$479.76	$118.93
5	Proportion screened using PCR test	0.70	0.90
6	Proportion symptomatic among Vax-Inf-Nothosp	0.68	0.52
7	Proportion symptomatic among Unax-Inf-Nothosp	0.78	0.62
8	Cost PCR test	$17.60	$21.52
9	Cost per PCR test implementation	$16.70	$20.62
10	Monthly probability of getting COVID (unhospitalized) among those who were vaccinated	0.02	0.01
Scenario analysis 3: Ag payer		***3a lower bound***	***3b upper bound***
1	Proportion vaccinated	0.20	0.90
2	Ag Specificity Symptomatic	0.92	1.00
3	Utility when symptomatic	0.55	0.75
4	Utility when asymptomatic	0.99	0.84
5	Ag Specificity Asymptomatic	0.99	1.00
6	Cost rapid Ag test	$4.52	$6.48

Top 10 most influential parameters		Lower bound input (optimistic ICER)	Upper bound input (pessimistic ICER)
7	Cost per Ag test implementation	$4.00	$5.96
8	Proportion symptomatic among Vax-Inf-Nothosp	0.6784	0.5216
9	Proportion symptomatic among Unax-Inf-Nothosp	0.77840	0.6216
10	Monthly probability of getting COVID + being hospitalized for COVID among those who were unvaccinated	0.00745	0.00586
Scenario analysis 4: Ag societal		***4a lower bound***	***4b upper bound***
1	Cost of daily lost productivity (daily wage)	$479.76	$118.93
2	Ag Specificity Symptomatic	1.00	0.92
3	Proportion vaccinated	0.20	0.90
4	Proportion screened using Ag test	0.70	0.90
5	Ag Specificity Asymptomatic	1.00	0.99
6	Proportion symptomatic among Vax-Inf-Nothosp	0.68	0.52
7	Isolation days	4.61	5.39
8	Proportion symptomatic among Unax-Inf-Nothosp	0.78	0.62
9	Symptomatic days	9.39	8.61
10	Cost of Ag test	$4.52	6.48

Supplemental Table 3.3. Published, peer-reviewed cost-effectiveness analyses evaluating various SARS-CoV-2 testing strategies in US settings[151,163–171]

Author	Type	Population	Perspective	Intervention	Comparator	Sensitivity analysis	Time horizons	Discount rate	Parameter index	Willingness to pay	Conclusion
Baggett et al. (2020)	Compartmental model (CEACOV)	Adult homeless shelter residents	Health care system	Daily symptom screening, universal PCR testing every 2 weeks, hospital-based or alternative care sites based COVID-19 care, and temporary housing	No intervention	Yes (DSA)	4 months (April-August 2020)	*Not reported*	ICER	$1,000/ case prevented	Daily symptom screening and alternative care sites was cost-effective (adding universal PCR testing every 2 weeks in surging epidemic)
Neilan et al. (2020)	Compartmental model (CEACOV)	General population	Health care system	PCR testing: hospital-based, symptom-based, symptom-based + asymptomatic 1x, symptom-based + asymptomatic 1x/monthly	Symptom-based testing	Yes	180 days	3%	ICER	$100,000/ QALY	Cost-effective
Losina et al. (2021)	Compartmental model (CEACOV)	Undergrad students and faculty at colleges	Societal (modified)	COVID-19 mitigation strategies (social distancing, masks, & routine laboratory screening)	No intervention	Yes	105 days (1 semester)	*Not reported*	ICER	$100,000/ QALY	Extensive social distancing with a mandatory mask wearing policy was cost-effective,

Author	Type	Population	Perspective	Intervention	Comparator	Sensitivity analysis	Time horizons	Discount rate	Parameter index	Willingness to pay	Conclusion
											routine laboratory testing was not
Paltiel et al. (2020)	Compartmental model	Students in residential college setting	*Not reported*	Rapid testing with daily - weekly frequency (i.e., every 1, 2, 3, 7 days)	Symptom-based testing	Yes	80 days (abbreviated semester)	*Not reported*	ICER	$5,500 ~ 11,600 /infection averted	Screening every 2 days using a rapid, inexpensive, and even poorly sensitive (>70%) test, coupled with strict behavioral interventions to keep Rt less than 2.5 was cost-effective
Paltiel et al. (2021)	Compartmental model	General population	Societal	Home-based rapid Ag testing: weekly	No intervention	Yes	60 days	*Not reported*	ICER	$5,000,000 ~17,000,000 /VSL	Cost-effective
Du et al. (2021)	Stochastic agent-based model	General population	Societal	8 rapid Ag testing strategies: daily - monthly frequency (i.e., every 1, 7, 14, 28 days) & isolation (1 vs. 2 weeks)	Symptom-based testing	Yes	150 days	A discrete-time discount factor	NMB	$100,000/ YLL averted	Cost-effective
Du et al (2022)	Stochastic agent-based model	Population in a typical US community	Societal	6,651 rapid mass proactive Ag testing strategies: daily -	No intervention (alt: status quo baseline symptomatic testing)	Yes	150 days	*Not reported*	NMB	$100,000/ averted YLL	Cost-effective

Author	Type	Population	Perspective	Intervention	Comparator	Sensitivity analysis	Time horizons	Discount rate	Parameter index	Willingness to pay	Conclusion
				monthly frequency (i.e., every 1, 7, 28 days) & isolation							
Savitsky et al. (2020)	Decision tree model	Health care workers	*Not reported*	Universal rapid testing	Universal PPE use	Yes (DSA and PSA)	*Not reported*	None	ICER	$25,000 /infection averted	Universal COVID-19 screening is generally the preferred option. However, universal PPE may be cost-effective and preferred in locations with high COVID-19 prevalence
Maya et al. (2022)	Decision tree model	Health care workers	*Not reported*	(1) only PCR test, (2) only Ag test (3) only IgG test, (4) conditional PCR test if IgG test is positive, and (5) concurrent IgG and PCR tests.	No tests	Yes (DSA and PSA)	*Not reported*	3%	ICER	-	Both PCR and Ag testing are beneficial strategies

Author	Type	Population	Perspective	Intervention	Comparator	Sensitivity analysis	Time horizons	Discount rate	Parameter index	Willingness to pay	Conclusion
Maya et al. (2022)	Decision tree model	Students, teachers, staff in K-12 Schools	Societal; School administration	(1) 1x/week Ag test (2) 2x/week Ag test (3) 1x/week PCR test (4) 1x/week Ag test + confirmatory PCR (5) 2x/week Ag test + confirmatory PCR	No tests	Yes (DSA and PSA)	9 months (April–December 2021)	3%	ICER	-	Cost-effective except Ag test(s) alone

Supplemental Table 3.4. Effectiveness and cost-effectiveness of expanded COVID-19 surveillance strategies by vaccination coverage: lower bound and upper bound scenario analyses results

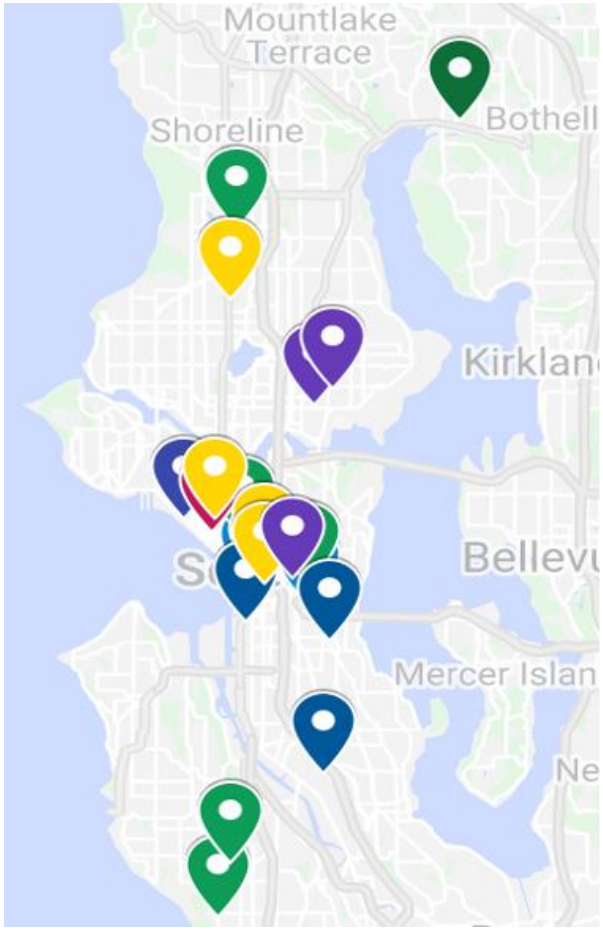
Testing scenario		Incremental Cost (2023 USD)	Incremental Effectiveness (QALYs gained)	ICER ($/QALY gained)
Healthcare payer perspective				
1. No surveillance		Ref	Ref	Ref
2. PCR testing*	Scenario analysis 1a (PCR payer lower bound)	$323	0.00461	$70,019
	Scenario analysis 1b (PCR payer upper bound)	$431	0.00020	$2,173,701
3. Ag testing^	Scenario analysis 3a (Ag payer lower bound)	$47	0.00655	$7,211
	Scenario analysis 3b (Ag payer upper bound)	$123	0.00012	$1,022,675
Limited societal perspective				
1. No surveillance		Ref	Ref	Ref
2. PCR testing*	Scenario analysis 2a (PCR societal lower bound)	-$301	0.00401	Dominant
	Scenario analysis 2b (PCR societal upper bound)	$477	0.00023	$2,099,511
3. Ag testing^	Scenario analysis 4a (Ag societal) lower bound	-$723	0.00201	-$384,485
	Scenario analysis 4b (Ag societal) upper bound	$216	0.00094	Dominant

* PCR testing compared to no surveillance
^ Ag testing compared to no surveillance

Supplemental Figure 3.1. Data analysis plan

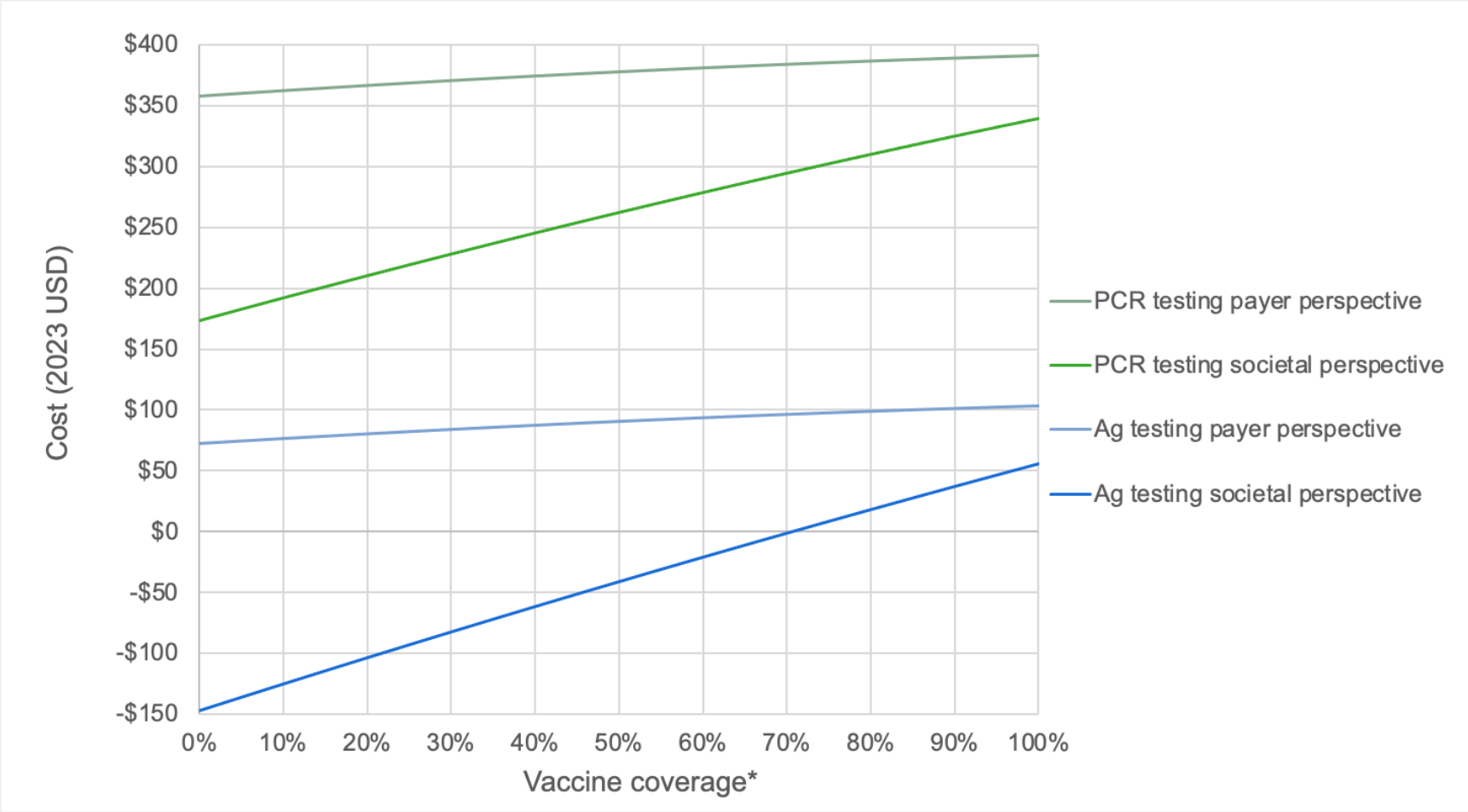
<table>
<tr><td colspan="2">We conducted a cost-utility analysis comparing a baseline surveillance scenario consisting of a no in-shelter surveillance strategy to two alternative strategies where shelter management actively encouraged all residents & staff to participate in testing with:
1) polymerase chain reaction (PCR) testing, or 2) rapid antigen (Ag) testing.</td></tr>
<tr><th>Preliminary analysis plan (complete)</th><th>Secondary analysis (complete)</th></tr>
<tr><td>In preliminary analyses, we developed a decision tree model to conduct the cost-utility analysis from both the healthcare payer and limited societal perspective over a one-year time horizon. Model inputs utilized data from congregate shelter residents aged ≥18 years who participated in the SFS between January 1, 2020 – May 31, 2021. The primary health outcome was quality-adjusted life-years (QALYs) gained due to averting COVID-19 disease. Healthcare and societal costs were estimated from standardized sources and literature review. All costs were converted to 2022 US dollars. We considered an intervention to be cost-effective if the incremental cost-effectiveness ratio (ICER) is $150,000/QALY and dominant if it saves costs and provides health effects. We addressed uncertainty with deterministic one-way sensitivity analyses.</td><td>In secondary analyses, we built a Markov model that incorporates dynamic incidence to simulate the transmission of SARS-CoV-2 in the congregate shelter population, to evaluate cost-utility over a one-year time horizon. Model inputs continued to utilize data from shelter residents aged ≥18 years who participated in the Seattle Flu Study (January 1, 2020 – May 31, 2021) and the primary health outcome will be quality-adjusted life-years (QALYs) gained due to averting COVID-19 disease. Healthcare and societal costs were estimated from standardized sources, literature review, and expert opinion. All costs were converted to 2023 US dollars. We considered an intervention to be cost-effective if the incremental cost-effectiveness ratio (ICER) is $150,000/QALY and dominant if it saves costs and provides health effects. We evaluated scenarios at various vaccination levels ranging from 20%-90%. We addressed uncertainty using both deterministic one-way sensitivity analyses and probabilistic sensitivity analyses.</td></tr>
</table>

Supplemental Figure 3.2. Map of Seattle Flu Study Shelter Locations



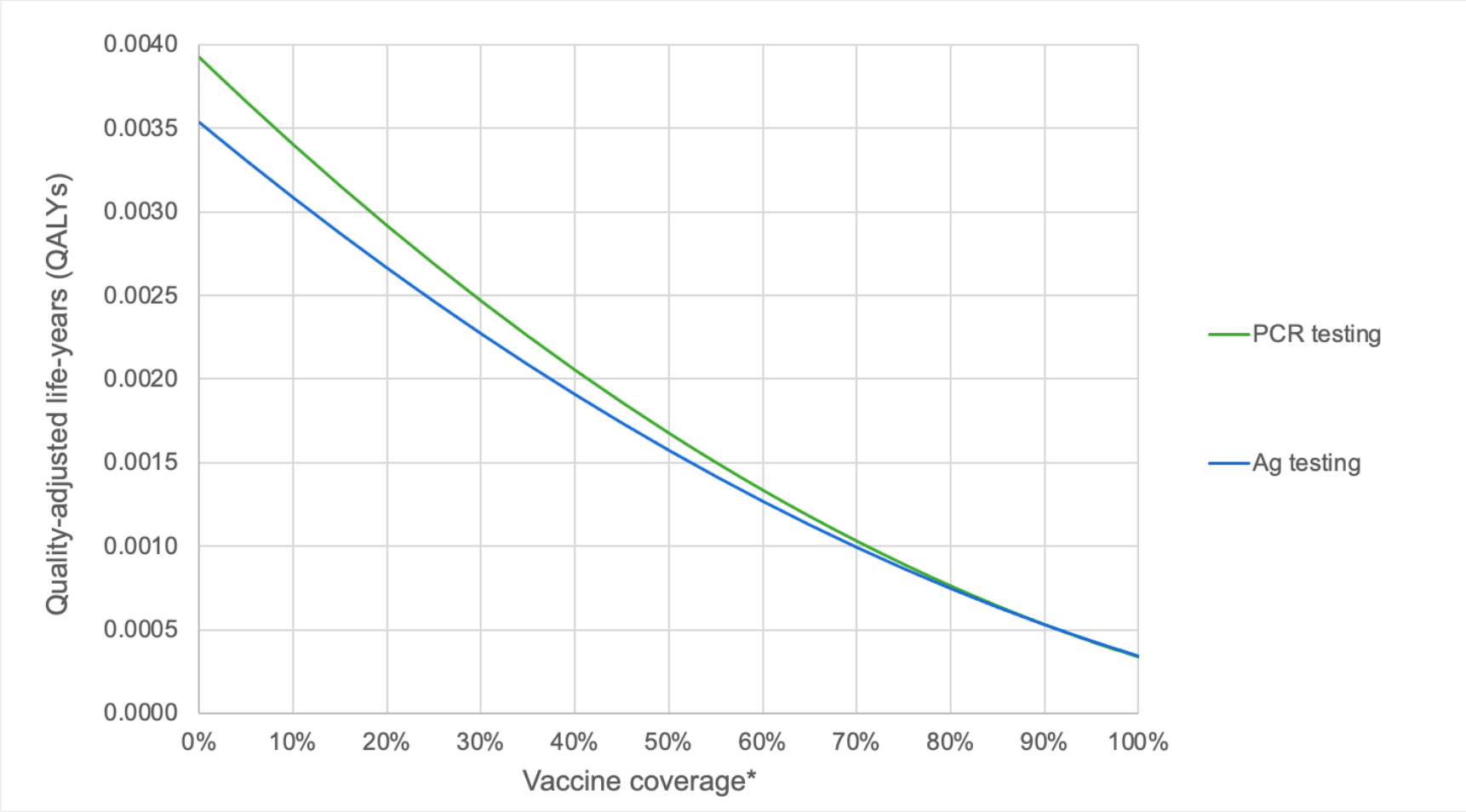
Legend:
Adult mixed gender shelters
Adult male shelters
Adult female shelters
Family shelters
Young adult shelters

Supplemental Figure 3.3.a. Cost per adult shelter resident by vaccine coverage, test type, and perspective



*Vaccine coverage represents the proportion of the population with at least one dose of COVID-19 vaccine

Supplemental Figure 3.3.b. Quality-adjusted life years per adult shelter resident by vaccine coverage, test type, and perspective



*Vaccine coverage represents the proportion of the population with at least one dose of COVID-19 vaccine

CONCLUSION

This work provided an opportunity to understand the burden of long COVID, the cost-effectiveness of testing, and opportunities to improve vaccination coverage among residents and staff in homeless shelters in Seattle-King County, Washington.

Our key findings include:

- COVID-19-positive shelter residents were at five times higher risk of persistent symptoms at follow-up when compared to COVID-19-negative controls; however, the majority of participants did not seek medical care.
- Intent to be vaccinated against COVID-19 was similar among residents and staff, increasing from March 2020 to August 2021 but lagging behind the King County general population. Participant recommendations to increase COVID-19 vaccination in shelter settings focused on improvement of information content and dissemination, vaccine access, and use of incentives.
- Lastly, we found that implementation of COVID-19 testing at shelters can be a cost-effective pandemic response. Models illustrated that most rapid Ag testing scenarios were cost-effective even at high vaccination coverage levels, while PCR testing was less effective and more costly than Ag testing.

Future Research

Our results highlight important information about COVID-19 and mitigation measures (e.g., testing, vaccination) in shelter settings, but also present opportunities for future research. The impact of long COVID should continue to be studied longitudinally in

people experiencing homelessness to understand further downstream impacts on health and care utilization. Additionally, future studies should test recommended vaccination strategies rooted in the voices and experiences of people experiencing homelessness to determine feasibility and effectiveness in shelter settings. Specifically, this can involve generation of prioritized content and dissemination of vaccine educational materials, as well as measuring implications of improved vaccine access and vaccine incentives. Our work provides grounds for research to understand vaccine decision-making and how to improve uptake during an outbreak or pandemic. Lastly, further research is needed to explore the costs and cost-effectiveness of SARS-CoV-2 testing as the COVID-19 disease incidence and landscape continues to evolve. Our model can be used as a base and incorporate updated parameters, especially as data measurement and quality improves to obtain more precise estimates for a given time frame. In particular, future data collection can focus on parameters identified with greatest influence on findings where there is large uncertainty.

Recommendations for Policymakers

Overall, we recommend policymakers use these findings to inform public health decisions and health service resource allocation among people experiencing homelessness for COVID-19. Findings provide a preliminary understanding of long COVID which can be used to prioritize interventions and support people experiencing homelessness. To increase COVID-19 vaccine uptake, recommendations include providing regular sources of trusted and tailored information, access to timely vaccine doses, and incentives. Specifically, shelter management, public health officials, and

health care providers can utilize these findings to inform and test COVID-19 vaccination interventions in shelters and among people experiencing homelessness. Additionally, decision-makers can use our modeled cost-effectiveness results to develop guidance for implementation of SARS-CoV-2 Ag testing to reduce morbidity and mortality in shelters and other congregate living settings.

REFERENCES

1. COVID Live - Coronavirus Statistics - Worldometer. https://www.worldometers.info/coronavirus/.
2. CDC. Disease of the Week - COVID-19. *Centers for Disease Control and Prevention* https://www.cdc.gov/dotw/covid-19/index.html (2021).
3. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020.
4. Notice on the Continuation of the National Emergency Concerning the Coronavirus Disease 2019 (COVID-19) Pandemic. *The White House* https://www.whitehouse.gov/briefing-room/presidential-actions/2022/02/18/notice-on-the-continuation-of-the-national-emergency-concerning-the-coronavirus-disease-2019-covid-19-pandemic-2/ (2022).
5. Inslee, J. Stay Home – Stay Healthy. PROCLAMATION BY THE GOVERNOR AMENDING PROCLAMATION 20-05. https://www.governor.wa.gov/sites/default/files/proclamations/20-25%20Coronovirus%20Stay%20Safe-Stay%20Healthy%20%28tmp%29%20%28002%29.pdf (2020).
6. Ruprecht, M. M. *et al.* Evidence of Social and Structural COVID-19 Disparities by Sexual Orientation, Gender Identity, and Race/Ethnicity in an Urban Environment. *J Urban Health* **98**, 27–40 (2021).

7. Zhu, A. *et al.* Respiratory infectious disease outbreaks among people experiencing homeless: A systematic review of prevention and mitigation strategies. *Ann Epidemiol* S1047-2797(22)00038–2 (2022) doi:10.1016/j.annepidem.2022.03.004.
8. US Department of Housing and Urban Development (HUD). What is Homeless Category 1: Literally Homeless? https://www.hudexchange.info/homelessness-assistance/coc-esg-virtual-binders/coc-esg-homeless-eligibility/four-categories/category-1.
9. Marcus, T. S. *et al.* Harm reduction in an emergency response to homelessness during South Africa's COVID-19 lockdown. *Harm Reduct J* **17**, 60 (2020).
10. Hammer, C. C., Brainard, J. & Hunter, P. R. Risk factors and risk factor cascades for communicable disease outbreaks in complex humanitarian emergencies: a qualitative systematic review. *BMJ Glob Health* **3**, e000647 (2018).
11. Potter, C. Outbreaks in Migrant Detention Facilities. *Outbreak Observatory* https://www.outbreakobservatory.org/outbreakthursday-1/7/11/2019/outbreaks-in-migrant-detention-facilities.
12. Tsai, J. & Wilson, M. COVID-19: a potential public health problem for homeless populations. *Lancet Public Health* **5**, e186–e187 (2020).
13. All Home. Seattle/King County Point-in-Time Count of Individuals Experiencing Homelessness. https://kcrha.org/king-county-point-in-time-count/ (2020).
14. Aldridge, R. W. *et al.* Morbidity and mortality in homeless individuals, prisoners, sex workers, and individuals with substance use disorders in high-income countries: a systematic review and meta-analysis. *Lancet* **391**, 241–250 (2018).

15. Leifheit, K. M., Chaisson, L. H., Medina, J. A., Wahbi, R. N. & Shover, C. L. Elevated Mortality Among People Experiencing Homelessness With COVID-19. *Open Forum Infect Dis* **8**, ofab301 (2021).
16. Leifheit, K. M. *et al.* Expiring Eviction Moratoriums and COVID-19 Incidence and Mortality. *Am J Epidemiol* **190**, 2503–2510 (2021).
17. Paudyal, V., Racine, M. & Hwang, S. W. COVID-19 vaccination amongst persons experiencing homelessness: practices and learnings from UK, Canada and the US. *Public Health* **199**, e2–e3 (2021).
18. CDC. Post-COVID Conditions. *Centers for Disease Control and Prevention* https://www.cdc.gov/coronavirus/2019-ncov/long-term-effects/index.html (2022).
19. Perri, M., Dosani, N. & Hwang, S. W. COVID-19 and people experiencing homelessness: challenges and mitigation strategies. *CMAJ* **192**, E716–E719 (2020).
20. Scott, E., Cox, S., Rogers, J., Wasse, J. & Chu, H. Prevalence and impact of post-acute sequelae of COVID-19 among people experiencing homelessness in King County, WA. (2021).
21. Rogers, J. H. *et al.* Trends in COVID-19 vaccination intent and factors associated with deliberation and reluctance among adult homeless shelter residents and staff, 1 November 2020 to 28 February 2021 - King County, Washington. *Vaccine* **40**, 122–132 (2022).
22. Chu, H. Y. *et al.* The Seattle Flu Study: a multiarm community-based prospective study protocol for assessing influenza prevalence, transmission and genomic epidemiology. *BMJ Open* **10**, e037295 (2020).

23. Rogers, J. H. *et al.* Characteristics of COVID-19 in Homeless Shelters : A Community-Based Surveillance Study. *Ann Intern Med* **174**, 42–49 (2021).
24. Cox, S. N. *et al.* Burden of long COVID among adults experiencing sheltered homelessness: a longitudinal cohort study in King County, WA between September 2020-April 2022. *BMC Public Health* **23**, 1079 (2023).
25. Subramanian, A. *et al.* Symptoms and risk factors for long COVID in non-hospitalized adults. *Nat Med* **28**, 1706–1714 (2022).
26. Hastie, C. E. *et al.* Outcomes among confirmed cases and a matched comparison group in the Long-COVID in Scotland study. *Nat Commun* **13**, 5663 (2022).
27. Mehandru, S. & Merad, M. Pathological sequelae of long-haul COVID. *Nat Immunol* **23**, 194–202 (2022).
28. Dani, M. *et al.* Autonomic dysfunction in 'long COVID': rationale, physiology and management strategies. *Clin Med (Lond)* **21**, e63–e67 (2021).
29. Nasserie, T., Hittle, M. & Goodman, S. N. Assessment of the Frequency and Variety of Persistent Symptoms Among Patients With COVID-19: A Systematic Review. *JAMA Netw Open* **4**, e2111417 (2021).
30. Global Burden of Disease Long COVID Collaborators *et al.* Estimated Global Proportions of Individuals With Persistent Fatigue, Cognitive, and Respiratory Symptom Clusters Following Symptomatic COVID-19 in 2020 and 2021. *JAMA* **328**, 1604 (2022).
31. Dryden, M. *et al.* Post-COVID-19 condition 3 months after hospitalisation with SARS-CoV-2 in South Africa: a prospective cohort study. *The Lancet Global Health* **10**, e1247–e1256 (2022).

32. Tobolowsky, F. A. *et al.* COVID-19 Outbreak Among Three Affiliated Homeless Service Sites - King County, Washington, 2020. *MMWR Morb Mortal Wkly Rep* **69**, 523–526 (2020).
33. Mosites, E. *et al.* Assessment of SARS-CoV-2 Infection Prevalence in Homeless Shelters - Four U.S. Cities, March 27-April 15, 2020. *MMWR Morb Mortal Wkly Rep* **69**, 521–522 (2020).
34. Baggett, T. P., Keyes, H., Sporn, N. & Gaeta, J. M. Prevalence of SARS-CoV-2 Infection in Residents of a Large Homeless Shelter in Boston. *JAMA* **323**, 2191–2192 (2020).
35. Cawley, C. *et al.* Mortality Among People Experiencing Homelessness in San Francisco During the COVID-19 Pandemic. *JAMA Network Open* **5**, e221870 (2022).
36. Imbert, E. *et al.* Coronavirus Disease 2019 Outbreak in a San Francisco Homeless Shelter. *Clin Infect Dis* **73**, 324–327 (2021).
37. Chopra, V., Flanders, S. A., O'Malley, M., Malani, A. N. & Prescott, H. C. Sixty-Day Outcomes Among Patients Hospitalized With COVID-19. *Ann Intern Med* **174**, 576–578 (2021).
38. Ladds, E. *et al.* Persistent symptoms after Covid-19: qualitative study of 114 'long Covid' patients and draft quality principles for services. *BMC Health Serv Res* **20**, 1144 (2020).
39. Goërtz, Y. M. J. *et al.* Persistent symptoms 3 months after a SARS-CoV-2 infection: the post-COVID-19 syndrome? *ERJ Open Res* **6**, 00542–02020 (2020).

40. Centers for Disease Control and Prevention. Health-Related Quality of Life (HRQOL): Measuring Healthy Days-Population Assessment of Health-Related Quality of Life. https://www.cdc.gov/hrqol/pdfs/mhd.pdf (2021).
41. Tran, V.-T., Porcher, R., Pane, I. & Ravaud, P. Course of post COVID-19 disease symptoms over time in the ComPaRe long COVID prospective e-cohort. *Nat Commun* **13**, 1812 (2022).
42. Townsend, J. P. *et al.* Projecting the seasonality of endemic COVID-19. 2022.01.26.22269905 Preprint at https://doi.org/10.1101/2022.01.26.22269905 (2022).
43. Lindsay, L. *et al.* Factors associated with COVID-19 viral and antibody test positivity and assessment of test concordance: a retrospective cohort study using electronic health records from the USA. *BMJ Open* **11**, e051707 (2022).
44. CDC. Cases, Data, and Surveillance. *Centers for Disease Control and Prevention* https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html (2020).
45. Jones, J. *et al.* Similarities and Differences in COVID-19 Awareness, Concern, and Symptoms by Race and Ethnicity in the United States: Cross-Sectional Survey. *J Med Internet Res* **22**, e20001 (2020).
46. Probst, J. C., Laditka, S. B., Moore, C. G., Harun, N. & Powell, M. P. Race and ethnicity differences in reporting of depressive symptoms. *Adm Policy Ment Health* **34**, 519–529 (2007).
47. Whitaker, M. *et al.* Persistent COVID-19 symptoms in a community study of 606,434 people in England. *Nat Commun* **13**, 1957 (2022).

48. Carvalho-Schneider, C. *et al.* Follow-up of adults with noncritical COVID-19 two months after symptom onset. *Clin Microbiol Infect* **27**, 258–263 (2021).
49. Sudre, C. H. *et al.* Attributes and predictors of long COVID. *Nat Med* **27**, 626–631 (2021).
50. Galal, I. *et al.* Determinants of persistent post-COVID-19 symptoms: value of a novel COVID-19 symptom score. *The Egyptian Journal of Bronchology* **15**, 10 (2021).
51. Cho, W. K. T. & Hwang, D. G. Racial/Ethnic, Biomedical, and Sociodemographic Risk Factors for COVID-19 Positivity and Hospitalization in the San Francisco Bay Area. *J Racial Ethn Health Disparities* (2022) doi:10.1007/s40615-022-01351-1.
52. van Westen-Lagerweij, N. A. *et al.* Are smokers protected against SARS-CoV-2 infection (COVID-19)? The origins of the myth. *npj Prim. Care Respir. Med.* **31**, 1–3 (2021).
53. Rogers, J. H. *et al.* Incidence of SARS-CoV-2 infection and associated risk factors among staff and residents at homeless shelters in King County, Washington: an active surveillance study. *Epidemiol Infect* **151**, e129 (2023).
54. Kiran, T. *et al.* Association of Homelessness with COVID-19 Positivity among Individuals Visiting a Testing Centre: A Cross-Sectional Study. *Healthc Policy* **17**, 34–41 (2022).
55. Kuehn, B. M. Homeless Shelters Face High COVID-19 Risks. *JAMA* **323**, 2240 (2020).

56. Leung, C. S., Ho, M. M., Kiss, A., Gundlapalli, A. V. & Hwang, S. W. Homelessness and the response to emerging infectious disease outbreaks: lessons from SARS. *J Urban Health* **85**, 402–410 (2008).
57. Patanwala, M. *et al.* Physical, Psychological, Social, and Existential Symptoms in Older Homeless-Experienced Adults: An Observational Study of the Hope Home Cohort. *J Gen Intern Med* **33**, 635–643 (2018).
58. Kristjansdottir, O. B. *et al.* Personal strengths reported by people with chronic illness: A qualitative study. *Health Expectations* **21**, 787–795 (2018).
59. Yoo, S. M. *et al.* Factors Associated with Post-Acute Sequelae of SARS-CoV-2 (PASC) After Diagnosis of Symptomatic COVID-19 in the Inpatient and Outpatient Setting in a Diverse Cohort. *J Gen Intern Med* **37**, 1988–1995 (2022).
60. University of Michigan. Long COVID: Women, Hispanics and lower-income Michiganders hit hardest. *University of Michigan News* https://news.umich.edu/long-covid-women-hispanics-and-lower-income-michiganders-hit-hardest/ (2022).
61. Harrell, F. E. *Regression Modeling Strategies: With Applications to Linear Models, Logistic and Ordinal Regression, and Survival Analysis*. (Springer International Publishing, 2015). doi:10.1007/978-3-319-19425-7.
62. Stone, C. S. & Koo, C. Additive splines in statistics. In Proceedings of the Statistical Computing Section ASA, Proceedings of the American Statistical Association. 45–48 (1985).

63. van Kessel, S. A. M., Olde Hartman, T. C., Lucassen, P. L. B. J. & van Jaarsveld, C. H. M. Post-acute and long-COVID-19 symptoms in patients with mild diseases: a systematic review. *Fam Pract* **39**, 159–167 (2022).
64. Logue, J. K. *et al.* Sequelae in Adults at 6 Months After COVID-19 Infection. *JAMA Netw Open* **4**, e210830 (2021).
65. Lutchmun, W., Gach, J., Borup, C. & Froeschl, G. Chronic diseases and multi-morbidity in persons experiencing homelessness: results from a cross-sectional study conducted at three humanitarian clinics in Germany in 2020. *BMC Public Health* **22**, 1597 (2022).
66. Baggett, T. P., Liauw, S. S. & Hwang, S. W. Cardiovascular Disease and Homelessness. *J Am Coll Cardiol* **71**, 2585–2597 (2018).
67. Baggett, T. P., O'Connell, J. J., Singer, D. E. & Rigotti, N. A. The unmet health care needs of homeless adults: a national study. *Am J Public Health* **100**, 1326–1333 (2010).
68. Purkey, E. & MacKenzie, M. Experience of healthcare among the homeless and vulnerably housed a qualitative study: opportunities for equity-oriented health care. *Int J Equity Health* **18**, 101 (2019).
69. Martins, D. C. Experiences of homeless people in the health care delivery system: a descriptive phenomenological study. *Public Health Nurs* **25**, 420–430 (2008).
70. Taghrir, M. H. *et al.* Inequity and disparities mar existing global research evidence on Long COVID. *Glob Health Promot* 17579759221113276 (2022) doi:10.1177/17579759221113276.

71. Vittinghoff, E., Glidden, D. V., Shiboski, S. C. & McCulloch, C. E. *Regression Methods in Biostatistics*. (Springer US, 2012). doi:10.1007/978-1-4614-1353-0.
72. Cox, S. N. *et al.* Trends and factors associated with change in COVID-19 vaccination intent among residents and staff in six Seattle homeless shelters, March 2020 to August 2021. *Vaccine X* **12**, 100232 (2022).
73. CDCMMWR. Preliminary Estimates of the Prevalence of Selected Underlying Health Conditions Among Patients with Coronavirus Disease 2019 — United States, February 12–March 28, 2020. *MMWR Morb Mortal Wkly Rep* **69**, (2020).
74. Montgomery, M. P. *et al.* Notes from the Field: COVID-19 Vaccination Coverage Among Persons Experiencing Homelessness - Six U.S. Jurisdictions, December 2020-August 2021. *MMWR Morb Mortal Wkly Rep* **70**, 1676–1678 (2021).
75. Meehan, A. A. *et al.* COVID-19 Vaccine Acceptability Among Clients and Staff of Homeless Shelters in Detroit, Michigan, February 2021. *Health Promot Pract* **23**, 35–41 (2022).
76. Kuhn, R. *et al.* COVID-19 vaccine access and attitudes among people experiencing homelessness from pilot mobile phone survey in Los Angeles, CA. *PLoS One* **16**, e0255246 (2021).
77. Endrich, M. M., Blank, P. R. & Szucs, T. D. Influenza vaccination uptake and socioeconomic determinants in 11 European countries. *Vaccine* **27**, 4018–4024 (2009).
78. Uddin, M. *et al.* Demographic and socioeconomic determinants of influenza vaccination disparities among university students. *J Epidemiol Community Health* **64**, 808–813 (2010).

79. Malik, A. A., McFadden, S. M., Elharake, J. & Omer, S. B. Determinants of COVID-19 vaccine acceptance in the US. *EClinicalMedicine* **26**, 100495 (2020).
80. Baumgaertner, B., Carlisle, J. E. & Justwan, F. The influence of political ideology and trust on willingness to vaccinate. *PLoS One* **13**, e0191728 (2018).
81. Fridman, A., Gershon, R. & Gneezy, A. COVID-19 and vaccine hesitancy: A longitudinal study. *PLoS One* **16**, e0250123 (2021).
82. Miton, H. & Mercier, H. Cognitive Obstacles to Pro-Vaccination Beliefs. *Trends Cogn Sci* **19**, 633–636 (2015).
83. Horne, Z., Powell, D., Hummel, J. E. & Holyoak, K. J. Countering antivaccination attitudes. *Proc Natl Acad Sci U S A* **112**, 10321–10324 (2015).
84. Goldman, R. D. *et al.* Willingness to Vaccinate Children against Influenza after the Coronavirus Disease 2019 Pandemic. *J Pediatr* **228**, 87-93.e2 (2021).
85. Caserotti, M. *et al.* Associations of COVID-19 risk perception with vaccine hesitancy over time for Italian residents. *Soc Sci Med* **272**, 113688 (2021).
86. Paasche-Orlow, M. K., Parker, R. M., Gazmararian, J. A., Nielsen-Bohlman, L. T. & Rudd, R. R. The prevalence of limited health literacy. *J Gen Intern Med* **20**, 175–184 (2005).
87. US Census Bureau. Week 34 Household Pulse Survey: July 21-August 2. *Census.gov* https://www.census.gov/data/tables/2021/demo/hhp/hhp34.html.
88. COVID Collaborative Institute for Health Metrics and Evaluation. Change in vaccine hesitancy by county: Jan 01, 2021 - Aug 05, 2021. *Institute for Health Metrics and Evaluation* https://vaccine-hesitancy.healthdata.org/ (2021).

89. Knight, K. R. *et al.* COVID-19 Testing and Vaccine Acceptability Among Homeless-Experienced Adults: Qualitative Data from Two Samples. *J Gen Intern Med* **37**, 823–829 (2022).
90. Thomas, J., Bowes, N., Meyers, R. & Thirlaway, K. Mental well-being and physical activity of young people experiencing homelessness before and during COVID-19 lockdown: A longitudinal study. *Ment Health Phys Act* **21**, 100407 (2021).
91. Jamison, A. M., Quinn, S. C. & Freimuth, V. S. 'You don't trust a government vaccine': Narratives of institutional trust and influenza vaccination among African American and white adults. *Soc Sci Med* **221**, 87–94 (2019).
92. Koritala, T. *et al.* A narrative review of emergency use authorization versus full FDA approval and its effect on COVID-19 vaccination hesitancy. *Infez Med* **29**, 339–344 (2021).
93. Khan, K. S., Mamun, M. A., Griffiths, M. D. & Ullah, I. The Mental Health Impact of the COVID-19 Pandemic Across Different Cohorts. *Int J Ment Health Addict* **20**, 380–386 (2022).
94. Perez-Arce, F. *et al.* COVID-19 vaccines and mental distress. *PLoS One* **16**, e0256406 (2021).
95. Balut, M. D., Chu, K., Gin, J. L., Dobalian, A. & Der-Martirosian, C. Predictors of COVID-19 Vaccination among Veterans Experiencing Homelessness. *Vaccines (Basel)* **9**, 1268 (2021).
96. Nguyen, K. H. *et al.* Report of Health Care Provider Recommendation for COVID-19 Vaccination Among Adults, by Recipient COVID-19 Vaccination Status and

Attitudes - United States, April-September 2021. *MMWR Morb Mortal Wkly Rep* **70**, 1723–1730 (2021).

97. Zlotnick, C., Zerger, S. & Wolfe, P. B. Health care for the homeless: what we have learned in the past 30 years and what's next. *Am J Public Health* **103 Suppl 2**, S199-205 (2013).
98. Kushel, M. B., Vittinghoff, E. & Haas, J. S. Factors associated with the health care utilization of homeless persons. *JAMA* **285**, 200–206 (2001).
99. Hwang, S. W. *et al.* A comprehensive assessment of health care utilization among homeless adults under a system of universal health insurance. *Am J Public Health* **103 Suppl 2**, S294-301 (2013).
100. Cox, S. N. *et al.* A qualitative analysis of COVID-19 vaccination intent, decision-making, and recommendations to increase uptake among residents and staff in six homeless shelters in Seattle, WA, USA. *Journal of Social Distress and Homelessness* **0**, 1–13 (2023).
101. Cha, S. *et al.* Morbidity and Mortality Among Adults Experiencing Homelessness Hospitalized With COVID-19. *J Infect Dis* **224**, 425–430 (2021).
102. Coustasse, A., Kimble, C. & Maxik, K. COVID-19 and Vaccine Hesitancy: A Challenge the United States Must Overcome. *J Ambul Care Manage* **44**, 71–75 (2021).
103. Gharpure, R. *et al.* Early COVID-19 First-Dose Vaccination Coverage Among Residents and Staff Members of Skilled Nursing Facilities Participating in the Pharmacy Partnership for Long-Term Care Program - United States, December 2020-January 2021. *MMWR Morb Mortal Wkly Rep* **70**, 178–182 (2021).

104. Hamel, L., Kirzinger, A., Lopes, L., Kearny, A., Sparks, G., & Brodie, M. KFF COVID-19 Vaccine Monitor: January 2021 - Vaccine Hesitancy. *KFF* https://www.kff.org/report-section/kff-covid-19-vaccine-monitor-january-2021-vaccine-hesitancy/ (2021).
105. Nguyen, K. H. *et al.* COVID-19 Vaccination Intent, Perceptions, and Reasons for Not Vaccinating Among Groups Prioritized for Early Vaccination - United States, September and December 2020. *MMWR Morb Mortal Wkly Rep* **70**, 217–222 (2021).
106. Fetters, M. D., Curry, L. A. & Creswell, J. W. Achieving integration in mixed methods designs-principles and practices. *Health Serv Res* **48**, 2134–2156 (2013).
107. Guetterman, T. C., Fetters, M. D. & Creswell, J. W. Integrating Quantitative and Qualitative Results in Health Science Mixed Methods Research Through Joint Displays. *Ann Fam Med* **13**, 554–561 (2015).
108. Creswell, J. W., & Plano Clark, V. L. *Designing and Conducting Mixed Methods Research*. (Sage Publications, 2018).
109. O'Cathain, A., Murphy, E. & Nicholl, J. Integration and Publications as Indicators of 'Yield' From Mixed Methods Studies. *Journal of Mixed Methods Research* **1**, 147–163 (2007).
110. Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J. & Neville, A. J. The use of triangulation in qualitative research. *Oncol Nurs Forum* **41**, 545–547 (2014).
111. Denzin, N. K. *The Research Act: A Theoretical Introduction to Sociological Methods*. (Routledge, 2017). doi:10.4324/9781315134543.

112. Patton, M. Q. Enhancing the quality and credibility of qualitative analysis. *Health Serv Res* **34**, 1189–1208 (1999).
113. The Health Belief Model: A Decade Later - Nancy K. Janz, Marshall H. Becker, 1984. https://journals.sagepub.com/doi/10.1177/109019818401100101.
114. Rosenstock, I. M. The Health Belief Model and Preventive Health Behavior. *Health Education Monographs* **2**, 354–386 (1974).
115. MacDonald, N. E. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* **33**, 4161–4164 (2015).
116. Dedoose Version 9.0.17, web application for managing, analyzing, and presenting qualitative and mixed method research data (2021). Los Angeles, CA: SocioCultural Research Consultants, LLC www.dedoose.com.
117. Potter, J. L. *et al.* Support of vulnerable patients throughout TB treatment in the UK. *J Public Health (Oxf)* **38**, 391–395 (2016).
118. Babando, J., Quesnel, D. A., Woodmass, K., Lomness, A. & Graham, J. R. Responding to pandemics and other disease outbreaks in homeless populations: A review of the literature and content analysis. *Health Soc Care Community* **30**, 11–26 (2022).
119. Onwubiko, U., Wall, K., Sales, R.-M. & Holland, D. P. Using Directly Observed Therapy (DOT) for latent tuberculosis treatment - A hit or a miss? A propensity score analysis of treatment completion among 274 homeless adults in Fulton County, GA. *PLoS One* **14**, e0218373 (2019).

120. Croft, L. A., Hayward, A. C. & Story, A. Tuberculosis peer educators: personal experiences of working with socially excluded communities in London. *Int J Tuberc Lung Dis* **17**, 36–40 (2013).
121. Heuvelings, C. C., de Vries, S. G. & Grobusch, M. P. Tackling TB in low-incidence countries: improving diagnosis and management in vulnerable populations. *Int J Infect Dis* **56**, 77–80 (2017).
122. Kitazawa, S. Tuberculosis health education. Needs in homeless shelters. *Public Health Nurs* **12**, 409–416 (1995).
123. Ohtsu, T. *et al.* Living conditions, ability to seek medical treatment, and awareness of health conditions and healthcare options among homeless persons in Tokyo, Japan. *Acta Med Okayama* **65**, 387–393 (2011).
124. Roy, A. *et al.* Evaluating knowledge gain from TB leaflets for prison and homeless sector staff: the National Knowledge Service TB pilot. *Eur J Public Health* **18**, 600–603 (2008).
125. Dong, L. *et al.* A qualitative study of COVID-19 vaccine intentions and mistrust in Black Americans: Recommendations for vaccine dissemination and uptake. *PLoS One* **17**, e0268020 (2022).
126. Lessard, D. *et al.* Barriers and facilitators to COVID-19 vaccine acceptability among people incarcerated in Canadian federal prisons: A qualitative study. *Vaccine X* **10**, 100150 (2022).
127. Rendleman, N. J. Mandated tuberculosis screening in a community of homeless people. *Am J Prev Med* **17**, 108–113 (1999).

128. Buccieri, K. & Stephen, G. Ethical Vaccine Distribution Planning for Pandemic Influenza: Prioritizing Homeless and Hard-to-Reach Populations. *Public Health Ethics* **6**, 185–196 (2013).
129. Kaplan-Weisman, L., Waltermaurer, E. & Crump, C. Assessing and Improving Zoster Vaccine Uptake in a Homeless Population. *J Community Health* **43**, 1019–1027 (2018).
130. Lerner, B. H. Temporarily detained: tuberculous alcoholics in Seattle, 1949 through 1960. *Am J Public Health* **86**, 257–265 (1996).
131. Batteux, E., Mills, F., Jones, L. F., Symons, C. & Weston, D. The Effectiveness of Interventions for Increasing COVID-19 Vaccine Uptake: A Systematic Review. *Vaccines (Basel)* **10**, 386 (2022).
132. Hall, V. *et al.* Protection against SARS-CoV-2 after Covid-19 Vaccination and Previous Infection. *N Engl J Med* **386**, 1207–1220 (2022).
133. Batko, S., Oneto, A. D. & Shroyer, A. Unsheltered Homelessness: Trends, Characteristics, and Homeless Histories. *METROPOLITAN HOUSING AND COMMUNITIES POLICY CENTER* 49 (2020).
134. Montgomery, A. E., Szymkowiak, D., Marcus, J., Howard, P. & Culhane, D. P. Homelessness, Unsheltered Status, and Risk Factors for Mortality. *Public Health Rep* **131**, 765–772 (2016).
135. Khanijahani, A., Iezadi, S., Gholipour, K., Azami-Aghdash, S. & Naghibi, D. A systematic review of racial/ethnic and socioeconomic disparities in COVID-19. *International Journal for Equity in Health* **20**, 248 (2021).

136. Magesh, S. *et al.* Disparities in COVID-19 Outcomes by Race, Ethnicity, and Socioeconomic Status: A Systematic-Review and Meta-analysis. *JAMA Netw Open* **4**, e2134147 (2021).
137. Chang, A. H. *et al.* COVID-19 Mortality Rates in Los Angeles County Among People Experiencing Homelessness, March 2020-February 2021. *Public Health Rep* **137**, 1170–1177 (2022).
138. de Sousa, T. *et al. The 2022 Annual Homelessness Assessment Report (AHAR) to Congress*. https://www.huduser.gov/portal/datasets/ahar/2022-ahar-part-1-pit-estimates-of-homelessness-in-the-us.html (2022).
139. Husereau, D. *et al.* Consolidated Health Economic Evaluation Reporting Standards 2022 (CHEERS 2022) Statement: Updated Reporting Guidance for Health Economic Evaluations. *Value Health* **25**, 3–9 (2022).
140. Institute for Clinical and Economic Review. 2020-2023 Value Assessment Framework. *ICER* https://icer.org/our-approach/methods-process/value-assessment-framework/.
141. Neumann, P. J. & Kim, D. D. Cost-effectiveness Thresholds Used by Study Authors, 1990-2021. *JAMA* **329**, 1312–1314 (2023).
142. The World Bank. GDP per capita (current US$) - United States | Data. https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=US.
143. Walgreens Co. Price listing. https://www.walgreens.com.
144. United States Department of Health & Human Services. HCUP facts and figures: statistics on hospital-based care in the United States. https://hcupnet.ahrq.gov/#setup.

145. Owens, D. K., Siegel, J. E., Sculpher, M. J. & Salomon, J. A. Designing a Cost-Effectiveness Analysis. in *Cost-Effectiveness in Health and Medicine* (eds. Neumann, P. J., Ganiats, T. G., Russell, L. B., Sanders, G. D. & Siegel, J. E.) 0 (Oxford University Press, 2016). doi:10.1093/acprof:oso/9780190492939.003.0004.
146. US Inflation Calculator. Find US Dollar's Value From 1913-2023. https://www.usinflationcalculator.com/ (2023).
147. Gold, M. R., Franks, P., McCoy, K. I. & Fryback, D. G. Toward consistency in cost-utility analyses: using national measures to create condition-specific values. *Med Care* **36**, 778–792 (1998).
148. Bartsch, S. M. *et al.* Lives and Costs Saved by Expanding and Expediting Coronavirus Disease 2019 Vaccination. *J Infect Dis* **224**, 938–948 (2021).
149. Wu, D. B. C. *et al.* Cost-utility analysis of antiviral use under pandemic influenza using a novel approach - linking pharmacology, epidemiology and heath economics. *Epidemiol Infect* **146**, 496–507 (2018).
150. Rebchuk, A. D., O'Neill, Z. R., Szefer, E. K., Hill, M. D. & Field, T. S. Health Utility Weighting of the Modified Rankin Scale: A Systematic Review and Meta-analysis. *JAMA Network Open* **3**, e203767 (2020).
151. Maya, S. *et al.* COVID-19 Testing Strategies for K-12 Schools in California: A Cost-Effectiveness Analysis. *Int J Environ Res Public Health* **19**, 9371 (2022).
152. Centers for Medicare & Medicaid Services (CMS). Medicare Administrative Contractor (MAC) COVID-19 test pricing. https://www.cms.gov/files/document/mac-covid-19-test-pricing.pdf (2020).

153. Seattle Flu Study. Expert opinion. (2023).

154. Smith, K. J., Lee, B. Y., Nowalk, M. P., Raymund, M. & Zimmerman, R. K. Cost-effectiveness of dual influenza and pneumococcal vaccination in 50-year-olds. *Vaccine* **28**, 7620–7625 (2010).

155. Smith, K. J. & Roberts, M. S. Cost-effectiveness of newer treatment strategies for influenza. *Am J Med* **113**, 300–307 (2002).

156. Rothberg, M. B. & Rose, D. N. Vaccination versus treatment of influenza in working adults: a cost-effectiveness analysis. *Am J Med* **118**, 68–77 (2005).

157. Perlroth, D. J. *et al.* Health outcomes and costs of community mitigation strategies for an influenza pandemic in the United States. *Clin Infect Dis* **50**, 165–174 (2010).

158. Lee, B. Y., Tai, J. H. Y., Bailey, R. R., Smith, K. J. & Nowalk, A. J. Economics of influenza vaccine administration timing for children. *Am J Manag Care* **16**, e75–e85 (2010).

159. Jit, M. *et al.* The cost-effectiveness of vaccinating pregnant women against seasonal influenza in England and Wales. *Vaccine* **29**, 115–122 (2010).

160. Danza, P. *et al.* SARS-CoV-2 Infection and Hospitalization Among Adults Aged ≥18 Years, by Vaccination Status, Before and During SARS-CoV-2 B.1.1.529 (Omicron) Variant Predominance - Los Angeles County, California, November 7, 2021-January 8, 2022. *MMWR Morb Mortal Wkly Rep* **71**, 177–181 (2022).

161. King County. COVID-19 trends: Outcomes by vaccination status. https://kingcounty.gov/depts/health/covid-19/data/trends.aspx.

162. Centers for Disease Control and Prevention. Estimated COVID-19 Burden. *Estimated COVID-19 Infections, Symptomatic Illnesses, Hospitalizations, and*

Deaths in the United States https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/burden.html (2021).

163. Savitsky, L. M. & Albright, C. M. Preventing COVID-19 Transmission on Labor and Delivery: A Decision Analysis. *Am J Perinatol* **37**, 1031–1037 (2020).
164. Maya, S. *et al.* Optimal strategies to screen health care workers for COVID-19 in the US: a cost-effectiveness analysis. *Cost Eff Resour Alloc* **20**, 2 (2022).
165. Baggett, T. P. *et al.* Clinical Outcomes, Costs, and Cost-effectiveness of Strategies for Adults Experiencing Sheltered Homelessness During the COVID-19 Pandemic. *JAMA Network Open* **3**, e2028195 (2020).
166. Neilan, A. M. *et al.* Clinical Impact, Costs, and Cost-effectiveness of Expanded Severe Acute Respiratory Syndrome Coronavirus 2 Testing in Massachusetts. *Clin Infect Dis* **73**, e2908–e2917 (2021).
167. Losina, E. *et al.* College Campuses and COVID-19 Mitigation: Clinical and Economic Value. *Ann Intern Med* **174**, 472–483 (2021).
168. Paltiel, A. D., Zheng, A. & Walensky, R. P. Assessment of SARS-CoV-2 Screening Strategies to Permit the Safe Reopening of College Campuses in the United States. *JAMA Netw Open* **3**, e2016818 (2020).
169. Paltiel, A. D., Zheng, A. & Sax, P. E. Clinical and Economic Effects of Widespread Rapid Testing to Decrease SARS-CoV-2 Transmission. *Ann Intern Med* **174**, 803–810 (2021).
170. Du, Z. *et al.* Comparative cost-effectiveness of SARS-CoV-2 testing strategies in the USA: a modelling study. *The Lancet Public Health* **6**, e184–e191 (2021).

171. Du, Z. *et al.* Cost-effective proactive testing strategies during COVID-19 mass vaccination: A modelling study. *Lancet Reg Health Am* **8**, 100182 (2022).
172. Zhou, L. *et al.* Cost-effectiveness of interventions for the prevention and control of COVID-19: Systematic review of 85 modelling studies. *J Glob Health* **12**, 05022 (2022).
173. Van de Velde, N., Brisson, M. & Boily, M.-C. Modeling human papillomavirus vaccine effectiveness: quantifying the impact of parameter uncertainty. *Am J Epidemiol* **165**, 762–775 (2007).
174. Centers for Medicare & Medicaid Services (CMS). Physician Fee Schedule.
175. Bureau of Labor Statistics. Occupational employment statistics: May 2020 State Occupational Employment and Wage Estimates- Washington. https://www.bls.gov/oes/2020/may/oes_wa.htm#00-0000.
176. Havers, F. P. *et al.* COVID-19-Associated Hospitalizations Among Vaccinated and Unvaccinated Adults 18 Years or Older in 13 US States, January 2021 to April 2022. *JAMA Internal Medicine* **182**, 1071–1081 (2022).
177. Srivatsan, S. *et al.* SwabExpress: An End-to-End Protocol for Extraction-Free COVID-19 Testing. *Clin Chem* **68**, 143–152 (2021).
178. Kortela, E. *et al.* Real-life clinical sensitivity of SARS-CoV-2 RT-PCR test in symptomatic patients. *PLOS ONE* **16**, e0251661 (2021).
179. Skittrall, J. P. *et al.* Specificity and positive predictive value of SARS-CoV-2 nucleic acid amplification testing in a low-prevalence setting. *Clin Microbiol Infect* **27**, 469.e9-469.e15 (2021).

180. Venekamp, R. P. *et al.* Diagnostic accuracy of SARS-CoV-2 rapid antigen self-tests in asymptomatic individuals in the omicron period: a cross-sectional study. *Clin Microbiol Infect* **29**, 391.e1-391.e7 (2023).
181. Schuit, E. *et al.* Diagnostic accuracy of covid-19 rapid antigen tests with unsupervised self-sampling in people with symptoms in the omicron period: cross sectional study. *BMJ* e071215 (2022) doi:10.1136/bmj-2022-071215.
182. Menni, C. *et al.* Symptom prevalence, duration, and risk of hospital admission in individuals infected with SARS-CoV-2 during periods of omicron and delta variant dominance: a prospective observational study from the ZOE COVID Study. *The Lancet* **399**, 1618–1624 (2022).

VITA

Sarah Nicole Cox completed her PhD in the Department of Epidemiology at the University of Washington in 2023. Her research focuses on communicable disease prevention, specifically, vaccine epidemiology, immunization access, infectious disease modeling, and reducing health disparities. Prior to completing her doctorate degree, she received her BSBA in Health Sector Management and Policy from the University of Miami and her MSPH in International Health – Global Disease Epidemiology and Control from the Johns Hopkins Bloomberg School of Public Health. Sarah's background encompasses diverse experiences in industry, government, & research. Additionally, she is the co-founder of two global non-profit organizations, One Sun Health, Inc. and Science Corps. Most recently, she worked as an Epidemiologist/Informatician for the San Francisco Department of Public Health specializing in population health data science, communicable disease surveillance, and health informatics. She utilizes a range of interdisciplinary methods including clinical epidemiology, economic evaluation, and implementation science to answer research questions with the ultimate goal of improving health access and well-being among marginalized populations globally.