

UTAH HERO PROJECT



Tracking Covid-19 to
Inform the Return to Normal



Report Published November 24, 2020

Included in this Report

- HERO Project Phase 1 - Part A summary & key findings
- Phase 1 - Part B summary & key findings
- Phase 2 - West Salt Lake summary & key findings
- Initial findings of the longitudinal analysis

TABLE OF CONTENTS

Kem C. Gardner Policy Institute - Policy Implications	1
Executive Summary	3
Project Background	3
Utah HERO Project Objectives	3
Project Timeline	3
Phase 1 - Part A By the Numbers	3
Testing and Sampling	4
Phase 1 - Part B By the Numbers	4
Interim Project Implications	5
November 24, 2020	5
Key Findings	7
Phase 1 - Part A: Salt Lake, Utah, Summit, and Davis Counties	7
Phase 1 - Part B: Washington, Cache, and Weber Counties	8
Phase 2	9
Phase 1 - Part A: Sampling Design and Project Implementation	10
Introduction	10
Characteristics of the Four-County Area	10
Primary Sampling Design	10
Secondary Sampling Design	11
Methods and Limitations	11
Hope Corps Field Teams & Testing	12
Household and Individual Surveys	13
Mobile Testing	14
Summary of Total Field Reach for Phase 1 - Part A	14
Graph: Responses by Household	15
Graph: Responses and Serology Samples by Individuals	15
Phase 1 - Part A: Results and Findings by Location	16
Introduction	16
Testing Sensitivity and Specificity	16
Primary Seroprevalence Results	17
Adjusted Seroprevalence by County	17
Adjusted Seroprevalence by Population Subgroup	18
Clinical Detection Rate	18
Infection Fatality Rate	19
PCR Results	19
Household Transmission Trends	19
Phase 1 - Part B: Washington County Sample and Results	20
Introduction	20

Washington County Sampling Design	20
Survey and Serology Response Rates in Washington County	20
Washington County Serology Results	21
Adjusted Seroprevalence by Population Subgroup	21
Prior Positives and PCR Results	22
Phase 1 - Part B: Cache County Sample and Results	23
Introduction	23
Cache County Sampling Design	23
Survey and Serology Response Rates in Cache County	23
Cache County Serology Results	24
Clinical Detection Rate	25
Adjusted Seroprevalence by Population Subgroup	25
Prior Positives and PCR Results	26
Phase 1 - Part B: Weber County Sample and Results	27
Introduction	27
Weber County Sampling Design	27
Survey and Serology Response Rates in Weber County	27
Weber County Serology Results	28
Clinical Detection Rate	29
Adjusted Seroprevalence by Population Subgroup	29
Prior Positives and PCR Results	29
Phase 2: West Salt Lake Sample and Results	30
Introduction	30
West Salt Lake Sampling Design	30
Survey and Serology Response Rates in West Salt Lake	30
West Salt Lake Serology Results	31
Clinical Detection Rate	31
Adjusted Seroprevalence by Population Subgroup	31
Prior Positives and PCR Results	32
Phase 2: Early Results of the Longitudinal Analysis	33
Introduction	33
Participation in Longitudinal Data Collection	33
Unadjusted Seroconversion and Seroreversion	34
Predictors of Seroconversion	34
Early Implications of Longitudinal Results	35
Next Steps	36
The HERO School Project	36
Ongoing Project Activities	36
In the Next Update	36
Acknowledgments	37

Utah HERO Project

Tracking Covid-19 to Inform Decision-Makers

Summary of Key Findings, Current Trends, and Implications

The Kem C. Gardner Policy Institute reviewed the research and results from the Utah Health and Economic Recovery Project (HERO Project). This summary includes eight key findings from this research and their associated implications. These implications focus on both public health and economic stability by advising Covid-19 mitigation strategies that promote personal protective measures. These measures allow businesses to remain open and people to remain employed. Protecting Utahns' health is an integral part of ensuring long-term economic stability.

Note: In developing evidence-based policy recommendations, the HERO Project's research and results are continuously reviewed in the context of emerging state and national research. The findings outlined below are based on early results. The implications developed from these initial results may change pending updated research.

1. Community prevalence of Covid-19 is increasing. The HERO Project uses community-wide blood (or serology) testing to estimate the occurrence of Covid-19 infections in the community (seroprevalence). Initial phases¹ of the HERO Project found community infection rates in Utah ranged from 0.5–2.8%. Recent data shows these rates are closer to 10%.

Implications: Reinforce the Governor's State of Emergency issued November 8–23, 2020, which includes a state-wide mask requirement, limits casual social gatherings to households-only, puts all youth and high school extracurricular activities on hold, and promotes weekly testing of students enrolled at public and private colleges and universities (who either live on campus or attend at least one in-person class per week). Encourage mask use between households and in public regardless of physical distancing. Keep businesses open with necessary mitigation strategies such as allowing employees to work remotely when possible, supporting delivery and curbside pickup, requiring mask use and increasing ventilation, and engaging in strict cleaning protocols and physical distancing.

2. There are around 1.5 unknown cases of Covid-19 for every known case. More recent data indicate this ratio may be rising.² This ratio of undetected to detected cases is lower than reported in other community studies, meaning Utah's testing performance in the early months of the public health emergency may have been more effective compared to other

states. It also shows there are more unknown cases of Covid-19 than known, meaning testing and contact tracing are not capturing all possible spread and that other means of reducing spread are needed.

Implications: Expand clinical testing, frequency of testing, and reliable testing results. Reduce the time it takes to receive results from days to hours to identify positive results and asymptomatic carriers more quickly, and to help reduce possible spread. Continue to leverage the National Guard to assist with expanded testing and contact tracing (Note: the National Guard is not being used for enforcement). Reinforce messaging that anyone with symptoms should be tested to help ensure accurate community detection rates and contact tracing.

3. Transmission rates among elementary- and middle-school age children are low (about 1–2%). The HERO project contributes to a growing body of research that shows transmission and infection rates among young children during school hours are low.

Implications: Prioritize in-person learning in combination with Covid-19 mitigation strategies for elementary, junior high, and middle schools. Reassess at an individual-school level if community spread becomes extensive.

4. Transmission rates among high-school age youth and young adults are higher (closer to 10%). Recent tests among some Utah high schools showed positivity rates as high as 10%, with a large portion of these students being asymptomatic. While in school transmission is low, higher rates of transmission appear to be coming from extracurricular and social activities. Transmission is now spreading to the broader community and vulnerable populations.

Implications: Employ structural shifts to enforce behavior change and/or stronger messaging to encourage behavior change. Structural shifts may include, but are not be limited to, encouraging more testing by providing appropriate incentives, or temporarily moving to remote learning and/or halting extracurricular activities to create a break in transmissions. Stronger messaging should focus on reasons why this group should support behavior change, what they can do to help their families, friends, and communities, and providing rewards for practicing personal protective measures.

5. Community prevalence varies by area and is higher among certain racial and ethnic groups and lower socioeconomic communities. For example, early findings from the HERO Project show community prevalence among Utah's Hispanic population ranged from 2.7–5.1%. Data on Covid-19 antibodies found among these communities can help Utah monitor equity gaps and develop more effective solutions to slow the spread for all communities in the state.

Implication: Develop community-specific interventions, including developing culturally appropriate and language-specific messaging on the importance of practicing personal protective measures, providing specific guidance on what personal protective measures are, increasing access to testing by providing testing at accessible places of care, and supporting community advocates with necessary resources to safely engage in the communities.

6. The secondary household infection rate is 12–15%. Initial data showed that within Utah households where at least one person has Covid-19 antibodies, 12.2% of the remaining individuals within the household are also likely to have antibodies. Current data shows this rate is now closer to 15% and exponentially increases if more than one person in a household tests positive.

Implications: Isolate family members who have tested positive and provide locations and social support for people to isolate when it is not possible to do so in their household. Encourage all household members to be tested for Covid-19 in order to determine the actual household positivity rate and appropriate level of quarantine.

7. Based on initial findings, the infection fatality rate is estimated to be about 0.3%. By assessing the number of undetected cases, the HERO Project estimates that the infection fatality rate among all people infected with Covid-19 (including both detected and undetected cases) was 0.3% as of August 10, 2020. Recent data show the infection fatality rate continues to remain low.

Implication: Continue to track infection fatality rates over time, but recognize this measure does not capture the full impact of Covid-19 infections. Focusing solely on mortality ignores other critical impacts including persistent and long-lasting Covid-19 symptoms and the strain on resources needed to treat serious cases. This strain is now acutely impacting intensive care and other critical care units in health care systems throughout Utah.

8. Antibodies seem to decrease over time. A number of individuals who had positive antibody tests in initial phases of the project did not test positive in subsequent phases. While some of this may be due to testing errors, it is more likely the result that Covid-19 antibodies decrease over time.

Implications: Conduct more research to better understand the relationship between antibodies and immunity (the HERO Project's tracking of Covid-19 antibodies will help assess the durability of immunity over time). Encourage people to continue to engage in personal protective measures, including mask wearing, physical distancing, and following the Governor's State of Emergency order even if they have tested positive for Covid-19 in the past.

The Utah Health and Economic Recovery Project (HERO Project) is a collaborative statewide surveillance project designed to help decision-makers understand community-based activity of the SARS-CoV-2 virus and Covid-19 infection rates. The goal of the HERO Project is to use local data to help Utah's citizens and economy return to normal in a safe and informed way. Primary project partners include The David Eccles School of Business, University of Utah Health, ARUP Laboratories, Hope Corps, and the Utah Governor's Office of Management and Budget.

Endnotes

- 1 Phase 1, Part A ran from May 1 – July 1, 2020. Phase 1, Part B ran from July 7 – August 15, 2020. The attached report includes initial findings from Phase 2 (as of September 15, 2020).
- 2 This rate is based on findings from Salt Lake and Davis counties. The rate for Utah County is still being calculated.

Executive Summary

Project Background

The Utah Health and Economic Recovery Project (HERO Project) is a collaborative statewide surveillance project designed to help decision-makers understand community-based activity of the SARS-CoV-2 virus and Covid-19 infection rates. The goal of the HERO Project is to use local data to help Utah's citizens and economy return to normal in a safe and informed way. Primary project partners include The David Eccles School of Business, University of Utah Health, ARUP Laboratories, Hope Corps, and the Utah Governor's Office of Management and Budget.

The sampling method described below is what sets the HERO Project apart from other testing efforts in the state. Overseen by a team of statisticians, researchers, and doctors, representative sampling is the only way to accurately estimate the prevalence of Covid-19 in the general population. Otherwise, we must rely on data from people who are sick enough to get themselves tested, which is a bit like trying to understand exercise trends among average Americans by surveying the participants of a marathon. The HERO Project establishes a system decision-makers can rely on to understand the full impact of the pandemic.

Utah HERO Project Objectives

To stop the spread of Covid-19 and responsibly re-engage in social and economic life, the State of Utah needs accurate information to manage the ongoing transitions from social distancing to the use of an advanced testing system that provides accurate and timely information to the systems that govern daily life across the state. The full project, which includes multiple phases, addresses the following key questions:

1. What is the current rate of infection in Utah? How is it changing over time?
2. What share of individuals with self-reported symptoms are infected?
3. What is the distribution of symptoms experienced by Covid-19 infected individuals?
4. What is the range of health outcomes experienced by Covid-19 infected individuals?
5. What proportion of Covid-19 infections are detected?

Project Timeline

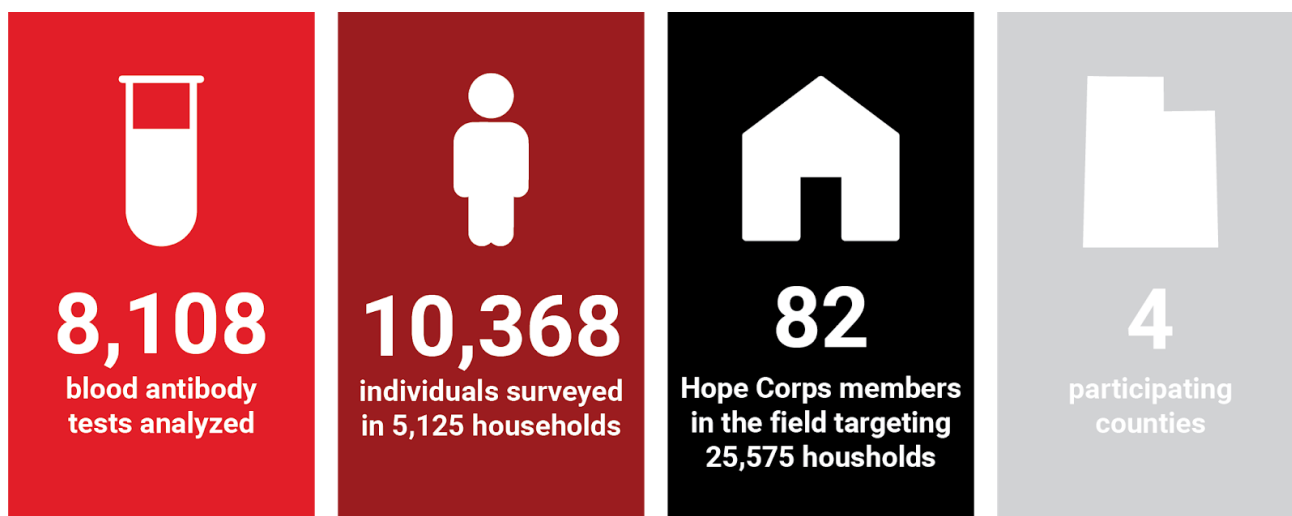
As the HERO Project continues, population sampling will continue in new areas of the state to provide additional local information that can be used for decision making.

Phase 1 - Part A: Between May 1 - July 1, 2020, the field team surveyed households and referred participants to mobile testing sites established in their neighborhoods. Counties in Phase 1 - Part A included Salt Lake, Utah, Summit, and Davis.

Phase 1 - Part B: Between July 7 - August 15, 2020, the project team extended county-level surveying into Washington, Weber and Cache counties.

Phase 2: Data collection in West Salt Lake, where the case count has been more concentrated. Phase 2 also includes a look at school transmission and longitudinal analysis.

Phase 1 - Part A By the Numbers



Testing and Sampling

The HERO project utilizes two laboratory tests to monitor the spread of the SARS-CoV-2 virus in Utah: (1) a nasal swab that tests for active infection, and (2) a blood test used to detect antibodies for the virus which can tell us who was previously infected. Together, data from these two tests describe the current status of infection, estimate how many infections the state is *not* detecting, and the potential immunity rates found in Utah's communities. Phase 1 - Part A surveys and tests were deployed strategically across Salt Lake, Utah, Summit, and Davis Counties by sampling neighborhoods with both high and low virus prevalence and diverse populations in order to get results that can be generalized to other communities who have not been surveyed and tested.

Phase 1 - Part B By the Numbers

1,594

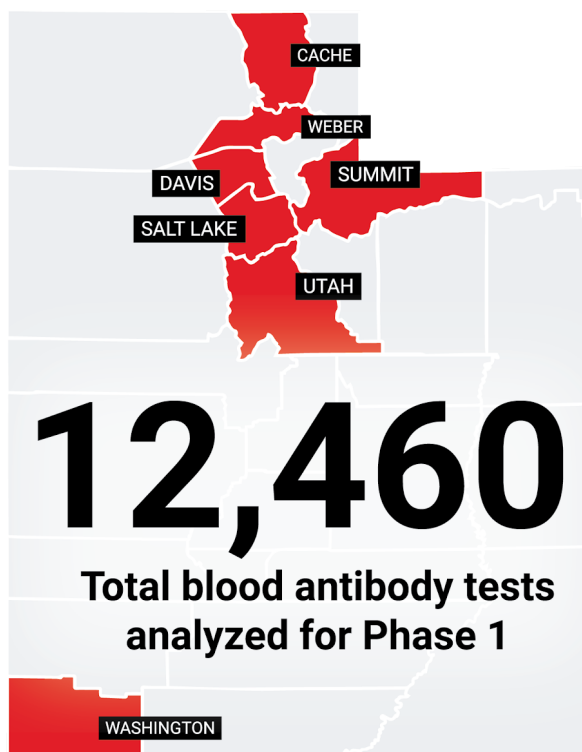
blood antibody tests analyzed in Washington County

1,538

blood antibody tests analyzed in Cache County

1,219

blood antibody tests analyzed in Weber County



Interim Project Implications

November 24, 2020

What We've Learned So Far:

1. So far, clinical testing in Utah has captured a reasonable percentage (30-65%) of the true total number of infections.
2. Based on antibody testing, the state is nowhere near achieving "herd immunity." This strategy could result in an additional 3,200 deaths in Utah.
3. The overall proportion of Utahns with Covid-19 antibodies has not increased significantly since the pandemic began, further confirming the unrealistic notion of herd immunity.
4. A closer look at infection transmission associated with school attendance has the potential to improve mitigation strategies, and more safely facilitate in-person instruction.

Dear Reader,

Community-wide testing for the HERO Project began in May 2020. Now, five months into testing and analysis in project areas throughout the state, we are able to assess trends in the data and draw out new implications of our findings.

First, clinical testing efforts across the state have consistently captured a reasonable percentage of Covid-19 cases. Starting with the initial four-county testing area (Salt Lake, Utah, Davis, and Summit), and into subsequent project areas (West Salt Lake, Washington, Weber, and Cache Counties), clinical detection ranged from 30% to 65% of the true total of infections determined by antibody testing. As the project is advanced, we have not yet seen any evidence of a decrease in the detection fraction, which represents the proportion of cases detected compared to the estimated total number of cases. However, it is critical to track the detection fraction in the current phase of the outbreak to ensure our estimate of community spread remains accurate. The longitudinal testing of Phase 2 of the HERO Project, with results due in early November, will provide further insights. Reports of growing reluctance to get tested in some areas and populations could give decision-makers a misleading picture of the extent of disease, the impact of control measures, and where to deploy resources.

Importantly, antibody testing continues to reveal that the vast majority of the population remains susceptible to the SARS-CoV-2 virus. Scientists are still working to better understand how the presence of antibodies can predict ongoing protection from the virus, but, even if antibodies indicate long-term immunity, the rates of seroprevalence in Utah's communities are nowhere near achieving "herd immunity." Even if we continue to experience high rates of infection, immunity due to natural infection will not lead to meaningful protection in the foreseeable future. Using the HERO Project's estimates of true infection, to date, approximately 300,000 Utahns have been infected. Conservative estimates of herd immunity that could help prevent the spread of infection (seroprevalence found in about 60% of the total population) would require that an additional 1.7

million Utahns become infected. Based on current hospitalization and death rates in the state, that would result in an additional 25,570 individuals hospitalized and 3,200 additional deaths.

The preliminary analysis of the longitudinal portion of the HERO Project found that the overall incidence of seroprevalence did not increase significantly between the end of June and early September. There has been a marked increase in coronavirus activity beginning in September and accelerating into October. The surge is in different geographic regions, predominantly Utah county and the southern end of Salt Lake County, and in different age and ethnic groups. Our project is working to shed light on the multiple factors responsible for this surge. In addition, we are exploring ways to measure the economic impact of the surge.

K-12 schools and universities represent one of the newest areas of concern for SARS-CoV-2 transmission. Efforts by the HERO Project to gain better understanding of infection transmission associated with school attendance and the impact of efforts to reduce viral spread through mitigation efforts (such as quarantining, hybrid teaching models and fully online teaching) were initially met with resistance due to concerns about increased detection making it more likely to detect positive cases above acceptable thresholds. However, by working collaboratively with school districts and local health departments in Davis and Salt Lake counties, we can monitor the development of surveillance strategies that are aligned with efforts to refine responses to detected cases that will aid in preserving in-person teaching to the extent possible. These refined responses could include more effective use of testing where and when it's needed, determination of safe early-return strategies based on data about in-class transmission, improved coordination of response strategies, and the validation of policies that keep students and teachers safe.

HERO Project leadership remains committed to ensuring the findings from this project are integrated into Utah's approach to managing the current public health crisis.

Sincerely,

Stephen C. Alder, PhD
Krow Ampofo, MD
Adam Hersh, MD

Adam Looney, PhD
Andrew T. Pavia, MD

Matt Samore, MD
Nathan Seegert, PhD

Key Findings

Phase 1 - Part A: Salt Lake, Utah, Summit, and Davis Counties Findings as of August 10, 2020

An Estimated 0.81% of Utahns age 12 or Older in the Four-County Area Have SARS-CoV-2 Antibodies

When an individual is exposed to the SARS-CoV-2 virus and is subsequently infected with Covid-19, their immune system makes antibodies that can be detected by testing for immunoglobulins in the blood. HERO Project leaders used this method of community-wide blood (or serology) testing, to estimate seroprevalence, or the occurrence of Covid-19 infections in the community. Phase 1 - Part A results revealed the overall four-county seroprevalence is 0.81%, or about 1 in 124 residents of these counties age 12 or older showed evidence of prior infection. The 95% confidence interval for seroprevalence in the four-county area is 0.15% to 1.61%.

The Estimated Clinical Detection Rate is About 40%

The clinical testing rate is the percentage of cases that are “caught” by testing through the available testing sites. Many Utah residents experiencing symptoms consistent with Covid-19 will seek out clinical testing from the healthcare system to confirm their diagnosis. However, not all residents seek testing, and some SARS-CoV-2 carriers do not have active symptoms. The HERO Project’s community-wide testing and analysis (as of tests dated to June-July of 2020) found that for every clinical case detection, there were approximately 1.5 cases that were *not* detected. This ratio of undetected to detected cases is lower than reported in other community seroprevalence studies, meaning Utah’s testing performance in the early months of the pandemic Utah was more effective compared to other states. The 95% confidence interval for the ratio of undetected to detected cases is 0.0 to 4.0.

The Infection Fatality Rate in Utah is About 0.3%

By estimating the number of undetected cases, HERO Project leaders were also able to provide a ballpark estimate of the infection fatality rate among all people infected with Covid-19, including both detected *and* undetected cases. The estimate of 1.5 undetected cases for each detected case translates to an infection fatality rate of about 0.3%, which gives Utah’s decision-makers more accurate information about potential fatality rates associated with future infections.

Infection Rates are Higher for Utah’s Hispanic Population and in Summit County

Across all project areas and subgroups in Phase 1 - Part A, seroprevalence was 0.81%. Comparatively, the seroprevalence of Hispanic Utahns was 2.73%— over three times higher. In Summit County, which reported a relatively early outbreak of cases, seroprevalence was 4.59%— over five times higher than the rest of the state. More accurate data about Covid-19 antibodies found among these populations helps Utah monitor equity gaps and develop more effective solutions to slow the spread for all communities in the state.

The Secondary Household Infection Rate is 12.2%

Household transmission of the SARS-CoV-2 virus is not a given. In fact, by surveying and testing full households of individuals in the four-county area, project leaders estimate a secondary infection rate within

households of 12.2%. That is, among households with at least one seropositive individual, we estimate that 12.2% of the remaining individuals in the household beyond the index case were also seropositive.

Phase 1 - Part B: Washington, Cache, and Weber Counties Findings as of September 15, 2020

An Estimated 0.51% of Utahns age 12 or Older in Washington County Have SARS-CoV-2 Antibodies

The adjusted seroprevalence for persons age 12 or older in Washington County is lower compared to the four-county sample in Phase 1 - Part A and other counties sampled in Phase 1 - Part B. Community-wide seroprevalence was 0.51%, or about 1 out of 195 individuals showed evidence of prior SARS-CoV-2 infection. Of note, Washington County is the only project focus area without a significantly higher seroprevalence rate for Hispanic participants.



It is important to interpret the results of all surveys, including the HERO Project, within the context of a margin of error which expresses the uncertainty in each result. This project expresses the margin of error in terms of 95% confidence intervals, which are defined to have a 95% chance of including the true result. The 95% confidence interval for seroprevalence in Washington County is 0%-1.59%.

An Estimated 2.31% of Utahns Age 12 or Older in Cache County Have SARS-CoV-2 Antibodies

Seroprevalence in Cache County was found to be higher compared to the four-county sample in Phase 1- Part A and the other counties sampled in Phase Part B. The estimated adjusted seroprevalence in Cache County is 2.31%, or about 1 in 42 respondents in Cache County age 12 or older showed evidence of prior infection. The 95% confidence interval for estimated seroprevalence in Cache County is 0.68%-5.71%.

The Estimated Clinical Detection Rate in Cache County is about 70%

By looking at the Covid-19 case counts 10-17 days prior to the date of testing in Cache County, HERO Project leaders can estimate what proportion of positive cases are detected using clinical tests, and what proportion goes undetected. Based on Cache County case counts and serology findings, the estimated clinical detection rate in Weber county is approximately 70%.

An Estimated 1.39% of Utahns age 12 or Older in Weber County Have SARS-CoV-2 Antibodies

The seroprevalence in Weber County also appeared to be slightly higher than the seroprevalence rate previously found for the four-county testing area for Phase 1 - Part A. Analysis of the blood antibody tests in Weber County revealed an adjusted seroprevalence of 1.39%, or about 1 in 72 respondents in Weber County age 12 or older showed evidence of prior infection. The 95% confidence interval for estimated seroprevalence in Weber is 0.27%-3.66%.

The Estimated Clinical Detection Rate in Weber County is about 65%

In the 10-17 days prior to blood serology testing for the area, the case rate for Weber County was 0.9%. Based on the case count rate and estimated seroprevalence in Weber County, the estimated clinical detection rate in Weber county is approximately 65%.

Seroprevalence in the Hispanic Community Remains Higher in Phase 1 - Part B

In both Cache and Weber Counties, seroprevalence is approximately twice as high for Hispanic community members compared to the overall rate of seroprevalence across the county.

Phase 2

Findings as of October 26, 2020

An Estimated 2.81% of West Salt Lake Residents 12 or Older Have SARS-CoV-2 Antibodies

Analysis of the blood antibody tests in West Salt Lake revealed an adjusted seroprevalence of 2.81%, or about 1 in 36 respondents in West Salt Lake age 12 or older showed evidence of prior infection. This finding was expected, as the West Salt Lake testing sampled local groups of city blocks whose case counts and levels of Hispanic ethnicity were in the top 10% in Salt Lake County. Reflecting the sampling design that was used, this is the highest community-wide seroprevalence found across all HERO testing areas. The confidence interval for estimated seroprevalence is 1.00%-6.36%. Seroprevalence among Hispanic respondents was found to be nearly twice as high compared to community-wide seroprevalence (5.11% compared to 2.81%) in the city blocks that were targeted for the West Salt Lake testing.

The Estimated Clinical Detection Rate in West Salt Lake is 60%

The case rate for the West Salt Lake testing in the 10-17 days prior to serology testing was 1.76%. Based on this rate and the seroprevalence estimate, the estimated clinical detection rate in West Salt Lake was about 60%.

Phase 1 - Part A: Sampling Design and Project Implementation

Introduction

Phase 1 - Part A of the HERO Project was designed to provide information about Covid-19 infections that can be used by decision-makers across the state. To capture an accurate picture of what's happening in Utah, project leaders carefully designed the methodology for sampling to ensure that important subgroups within the community are represented. To do this, the HERO Project utilized a primary and secondary strategy to build a sample that represents all residents. The primary sampling design included an intense recruitment process performed within specifically selected population clusters. The secondary sampling design was broader and more inclusive. Together, these two strategies help source a well-rounded set of data for further investigation.

An essential component of achieving accurate representation was sampling from four counties: Salt Lake County, Utah County, Davis County, and Summit County. Areas within each county were examined to create strata, or groups, using U.S. Census-defined tracts and blocks. Residents in these strata were then contacted by the project and asked to complete household and individual surveys. Residents age 12 or older were then referred for blood and/or nasal swab testing.

Characteristics of the Four-County Area

	Population Size (individuals)	% Hispanic	Median Age
County			
Davis	340,621	9.4%	30.8
Salt Lake	1,120,805	18.1%	32.6
Utah	590,440	11.6%	24.6
Summit	40,511	11.5%	39.0

Source: 2018 5-year estimates of the American Community Survey.

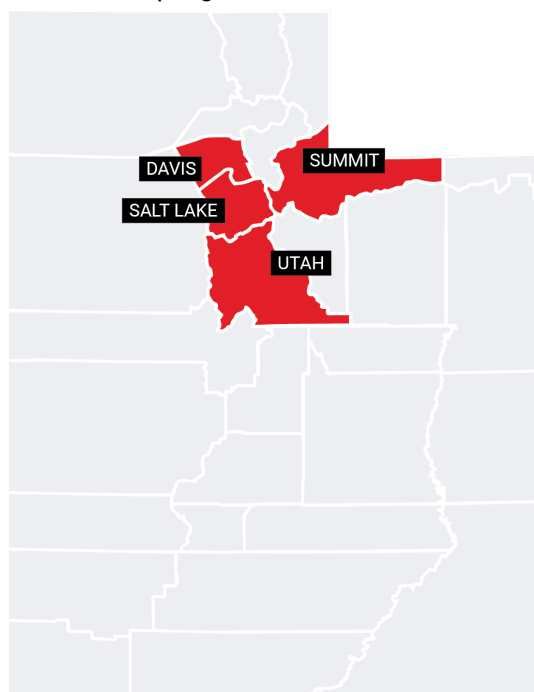
Primary Sampling Design

The primary sampling design designated 15 strata which were defined using public data about the age and ethnicity of residents as well as state case count data. Since older individuals are more vulnerable to Covid-19, strata were described by young or old populations; since there have been higher incidences nationwide of transmissions in populations of color, strata were defined as Hispanic or Non-Hispanic; and finally, since project leaders aimed to better understand transmission, strata were defined as having high or low case prevalence. The designation of strata helped to assure

an adequate representation of each of these groups. The project targeted 25,575 households in the primary sampling design. These households were approached using an intensive sampling process that included both mailings with a web survey and door to door sampling.

Secondary Sampling Design

The secondary sampling design also used strata defined by case prevalence, Hispanic ethnicity, and age in the four counties selected for Phase 1 - Part A. In contrast to the primary sampling design, households were sampled broadly across the full geographic areas of the respective counties. In total, 14,012 households were selected and asked to participate as part of the secondary sampling design. In order to make sampling across broad geographic areas feasible, a less intensive sampling process was used for the secondary sampling design than was used for the primary sampling design.



Geographic Areas Sampled in the Primary and Secondary Sampling Designs

Methods and Limitations

As is standard for survey designs similar to the type implemented in the HERO Project, the statistical analyses for Phase 1 - Part A include corrections to account for a variety of considerations including sampling, nonresponse, demographic balance, and the accuracy of the two clinical tests used. This process includes assigning higher weights to correct for undersampling subsets of the data. All the seroprevalence results of this report reflect adjusted findings unless stated otherwise.

The primary limitation in the HERO Project analyses is that estimates of community seroprevalence of Covid-19 have a degree of uncertainty. This uncertainty has several sources, much like that in similar studies. First, weighting and other adjustments to the data might not be perfect. Second, manufacturers of clinical tests pre-determine the likely accuracy of tests, and these estimates could also affect interpretation of the results. As described earlier in this report, to account for these errors, the HERO Project established confidence intervals for all findings which can be used to interpret each estimate presented.



Hope Corps Field Teams & Testing

In partnership with Utah Community Builders, The David Eccles School of Business at the University of Utah established the Hope Corps in response to state-wide impacts of the Covid-19 pandemic. The mission of the Hope Corps is to assist and lift small businesses, nonprofits, and the people of Utah. College students applied to join the Corps, and these dedicated young professionals staffed field teams and organized mobile testing sites to collect blood and nasal swabs from participants.



Household and Individual Surveys

Surveys used in Phase 1 - Part A of the HERO Project gathered information about participant attitudes and behaviors in response to the Covid-19 pandemic, as well as demographic information. Selected participants were sent mailers with project information and instructions to complete household and individual surveys online. Field teams walked door to door in the neighborhoods selected for sampling to further encourage participation. The teams provided information about the HERO Project, described the process, and then delivered surveys to willing participants.



Mobile Testing

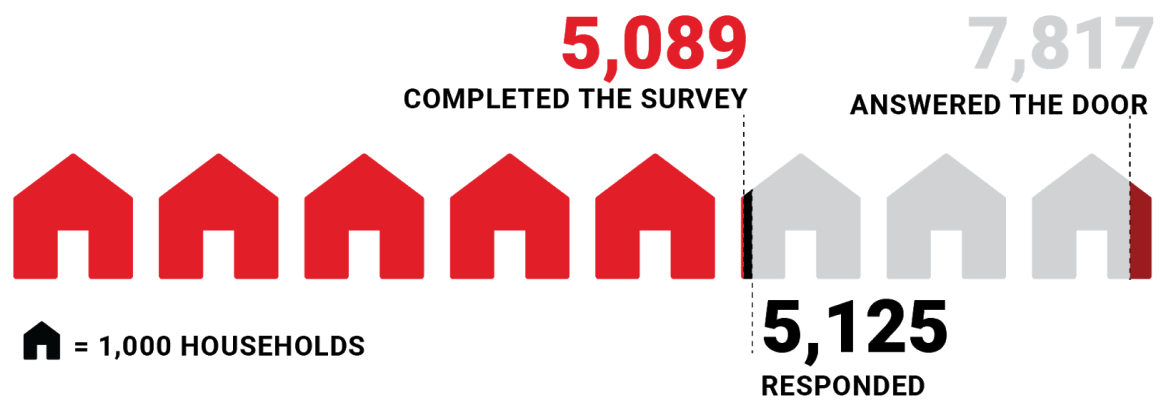
Participants who completed surveys selected a time the following day to complete their tests at a mobile testing site. These sites were established in conveniently located parking lots so participants could drive through and limit their contact with staff. Both nasal swabs and venous blood draws were available at the site; participants over age 12 provided a blood sample and some participants provided a nasal swab.

Summary of Total Field Reach for Phase 1 - Part A

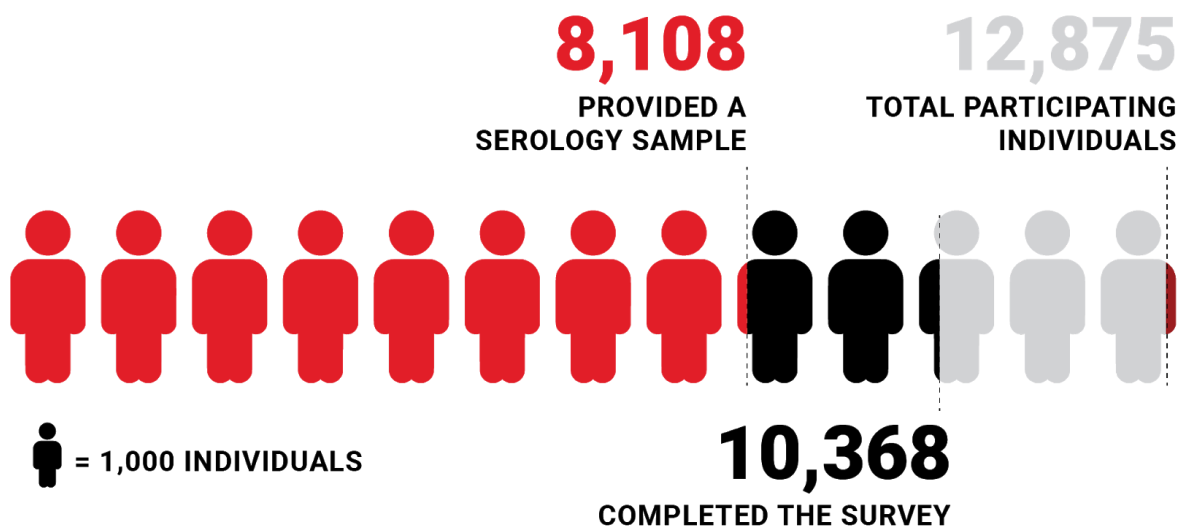
- 5,125 households completed the household survey
- 10,368 individuals completed the individual survey
- 8,108 individuals provided blood tests for serology analysis
- 6,004 individuals were given the PCR nasal swab test

All serology samples in Phase 1 - Part A were collected between May 1 and July 3, 2020. The majority of these blood tests (6,606 out of 8,108) were obtained between May 18 and June 19, 2020.

Graph: Responses by Household



Graph: Responses and Serology Samples by Individuals



Phase 1 - Part A: Results and Findings by Location

Introduction

The primary focus of the HERO Project is to estimate seroprevalence, which can help decision-makers estimate potential Covid-19 immunity due to the presence of antibodies in Utah residents' blood. In addition, the project also used zip code specific case counts and nasal swab tests to estimate what proportion of active cases are detected in a clinical setting. This section presents these findings, as well as the relationship between the findings and responses to the household and individual surveys.

Findings from Phase 1 - Part A of the HERO Project are a result of careful analysis that account for best practices consistent with large scale community-wide studies of health. In addition to the adjustments made for sampling that allowed project leaders to make accurate assumptions about the population, the analysis of clinical tests is informed by the test manufacturer's estimates of accuracy and the project's own estimates of test accuracy. Therefore all results in this section have been adjusted in accordance with these best practices.

Testing Sensitivity and Specificity

Once participant samples were submitted to ARUP Laboratories, technologists followed strict procedures to complete the test, for each sample. The accuracy of tests is defined by sensitivity and specificity. Sensitivity refers to the ability of the test to correctly identify those with the disease, or the true positive rate. Specificity describes the ability of the test to correctly identify those without the disease, or the true negative rate. Based on self-reports from participants who indicated having a prior positive Covid-19 test, project leaders adjusted the sensitivity estimate based on how many of those participants also tested positive for antibodies. This process changed the sensitivity used in the adjustment from the manufacturer's estimate of 0.972 to a HERO Project sensitivity estimate of 0.83. The project used the manufacturer's specificity estimate of 0.996, which the manufacturer obtained by evaluating 1,070 samples collected prior to the start of the Covid-19 outbreak.

INDIVIDUALS OVER AGE 12 TESTED FOR ANTIBODIES ACROSS THE 4-COUNTY AREA



1 in 124 I.E., **0.81%**
TESTED POSITIVE SEROPREVALENCE

Primary Seroprevalence Results

Based on Phase 1 - Part A, the estimate of seroprevalence is 0.81%, with a 95% confidence interval ranging from 0.15% to 1.61%. The estimated prevalence of 0.81% reflects the best estimate of the prevalence of Covid-19 among those 12 years and older across the four-county area: roughly 1 in 124 individuals. It is important to interpret this estimate of prevalence in the context of its 95% confidence interval, which reflects the uncertainty associated with random sampling and potential testing error.

Adjusted Seroprevalence by County

The table below includes the total number of blood tests collected for each county, the number of positive test results, and the adjusted seroprevalence. The project found a higher prevalence in Summit County, the location of the state's first Covid-19 outbreak in Park City, Utah.

	Total Serology Tests Received From ARUP	Positive Serology Test Results	Adjusted Seroprevalence (%)	Seroprevalence 95% Confidence Interval (%)
County				
Davis	1,703	16	0.15	0.00-1.26
Salt Lake	4,021	38	0.70	0.00-1.78
Summit (Park City)	345	10	4.59	1.02-15.11
Utah	2,039	25	1.21	0.12-3.41
All	8,108	89	0.81	0.15-1.62

Adjusted Seroprevalence by Population Subgroup

The table below lists the seroprevalence for population subgroups, including participant age, sex, and Hispanic ethnicity. As is consistent with communities across the nation, the Hispanic population in the four-county project area demonstrates a significantly higher seroprevalence. The table also includes survey-collected data showing the correlation between seroprevalence and known contact with an infected individual, and living in a household with another seropositive individual. As expected, known contact and sharing a household with a seropositive individual is correlated with increased rates of infection.

Because seroprevalence is low overall, the confidence intervals for different subpopulations often overlap.

	Adjusted Seroprevalence (%)	Seroprevalence 95% Confidence Interval (%)
Population Subgroup		
Age [12 – 45]	0.88	0.10-2.07
Age [45 – 65]	0.80	0.11-1.70
Age [65 +]	0.45	0.00-1.36
Male	0.74	0.05-1.65
Female	0.89	0.17-1.85
Non-Hispanic	0.48	0.00-1.09
Hispanic	2.73	0.62-8.01
Known contact: No	0.41	0.00-1.12
Known contact: Yes	8.51	3.27-19.66
Known contact: Don't Know	0.24	0.00-1.47
Reside in household with another seropositive individual	24.88	10.55-49.33
Reside in household without a seropositive individual	0.32	0.00-0.88

Clinical Detection Rate

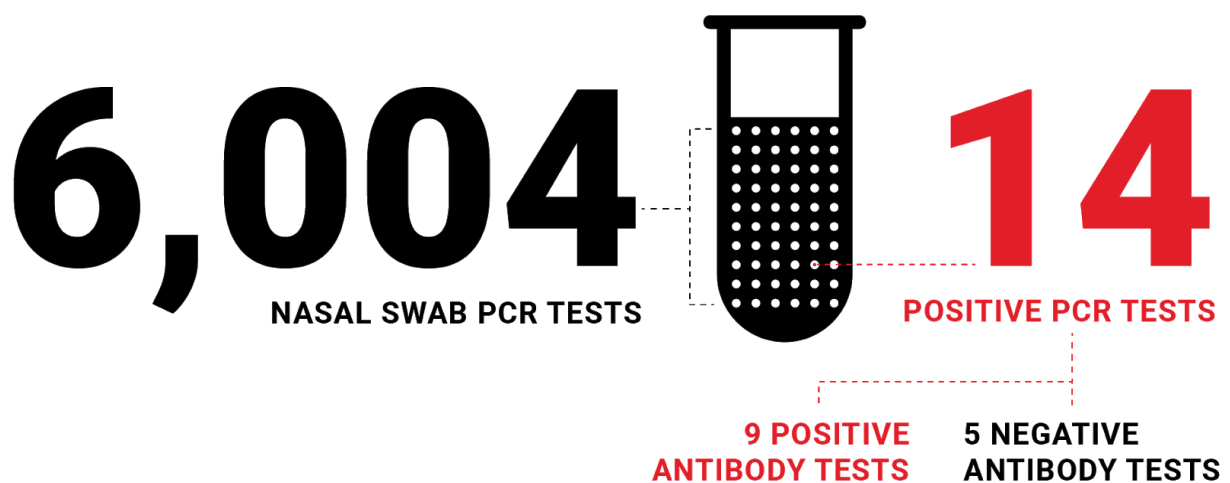
Since not all individuals experiencing symptoms get tested, and some do not experience symptoms, the sampling method used in the project gives an indication of how many active cases are missed. To better understand the rate of clinical detection in the four-county area, HERO Project leaders examined seroprevalence alongside the positive case count in participants' zip codes between 10 - 17 days prior to the blood test. The positive case count gives an indication of what one might expect seroprevalence to look like. By comparing the case count collected in clinical settings to the random sample in Phase 1 - Part A, the project estimated about 40% of cases are detected. In other words, for every detected case, another 1.5 active cases go undetected.

Since testing included only residents with age 12 and older, the clinical detection rate is subject to some uncertainty since it does not account for young children.

Infection Fatality Rate

The case fatality rate is commonly calculated as the number of deaths divided by the number of clinically diagnosed cases, adjusted for the delay between diagnosis and death. This can be misleading because it does not accurately count all of the infections. The clinical detection rate also helped project leaders determine an estimated infection fatality rate (deaths divided by the true number of infections) of approximately 0.3% among those 12 years or older. This factors in fatality among both detected *and* undetected cases. Similar to the limitations of the estimated clinical detection rate, the infection fatality rate is subject to some uncertainty given the exclusion of children under 12.

PCR Results



Over the course of Phase 1 - Part A testing, 6,004 nasal swab PCR tests were administered and 14 tests came back positive. Six of the individuals with positive PCR results reported having a prior positive PCR test. Of the 14 individuals with positive PCR results, 9 individuals also had a positive antibody test, and 5 individuals had a negative antibody test.

Household Transmission Trends

A total of 56 households had at least two individuals tested and at least one individual who was seropositive. By assuming there was one primary case in each household, the project was able to estimate the rate of secondary infection within a household. Within these 56 households, 70 individuals were seropositive and 101 were seronegative, resulting in 14 secondary seropositive individuals. Based on this sample, the four-county estimated secondary household infection rate is 12.2%. In other words, for households with at least one seropositive individual, an estimated 12.2% of the remaining individuals within that household were also seropositive.

Phase 1 - Part B: Washington County Sample and Results

Introduction

Washington County was the next county sampled after the initial four-county sample in Phase 1 - Part A of the HERO Project. Testing in Washington County included both blood antibody and nasal swab PCR tests taken between July 7-14, 2020. Results in this section are adjusted using methods described earlier in this report for Phase 1 - Part A. These adjustments account for a variety of considerations including sampling, nonresponse, demographic balance, and the accuracy of the two clinical tests used. Where available, confidence intervals are presented alongside the adjusted results to provide context for the interpretation.

Washington County Sampling Design

A simple random sample of addresses was used to create a targeted sample group in Washington County. A total of 12,500 households were identified and sent a mailed invitation to participate in the project and complete household and individual surveys. Households were given different levels of participation incentives to be able to test for and correct for nonresponse bias. Individuals age 12 and older who completed the survey were invited to provide a blood sample for antibody testing.

Survey and Serology Response Rates in Washington County

HERO Project leaders carefully monitored response rates throughout the project to ensure outreach efforts were effective and sampling results were representative of the area. The table below summarizes response rates based on completion of the household survey, individual survey, and the individuals who provided a blood serology test. Household response rate is presented as a ratio of households who either completed the household survey or at least one individual survey. Individual response rates are presented as the proportion of individuals age 12 or older that completed the individual survey. Serology response rates are presented as the proportion of individual survey respondents who also provided a serology sample. The overall response is estimated as the product of the household, individual, and serology level response rates.



12,500 Contacted via Mail (#Responded/Completed)	
Response	
Household Survey	931
Individual Survey	1,827
Blood Test	1,594
Overall Response Rate	5.4%

Washington County Serology Results

Out of 1,594 blood antibody tests, 14 of the samples obtained were positive. The adjusted community-wide seroprevalence for persons age 12 or older in Washington County is 0.51%, or about 1 out of 195 individuals showed evidence of prior SARS-CoV-2 infection. This rate is lower than the overall seroprevalence determined in the four-county Phase 1 - Part A findings. This finding has been adjusted using the HERO Project derived 0.83 test sensitivity estimate, and the manufacturer's specificity estimate of 0.996. The confidence interval for seroprevalence in Washington County is 0%-1.59%.

Adjusted Seroprevalence by Population Subgroup

Consistent with lower community seroprevalence, adjusted seroprevalence by population group is also lower overall. Seroprevalence in Washington County appears to be higher for individuals between the ages of 45-65, and those who had known contact with a positive individual. Confidence Intervals are not available by population subgroup due to the small sample size. The adjusted seroprevalence results account for testing error and include corrections to adjust for nonresponse.

	Total Number	Total Number Seropositive	Adjusted Seroprevalence (%)
Population Subgroup			
Age [12 – 45]	472	1	0.00
Age [45 – 65]	413	8	2.35
Age [65 +]	708	5	0.57
Male	738	7	0.66
Female	851	7	0.37
Non-Hispanic	1,522	13	0.52
Hispanic	56	1	0.54
Known contact: No	1,115	7	0.5
Known contact: Yes	74	4	2.79
Known contact: Don't Know	402	3	0.00
Reside in household with another seropositive individual	14	0	0.00
Reside in household without a seropositive individual	1,580	14	0.52

Prior Positives and PCR Results

Out of the 1,594 individuals who provided a blood sample, 225 individuals self-reported they had received a prior Covid-19 PCR nasal swab test, and 11 individuals reported a prior positive test result. Further PCR tests found an additional 5 positive individuals out of 14 individuals positive for blood antibodies.

Phase 1 - Part B: Cache County

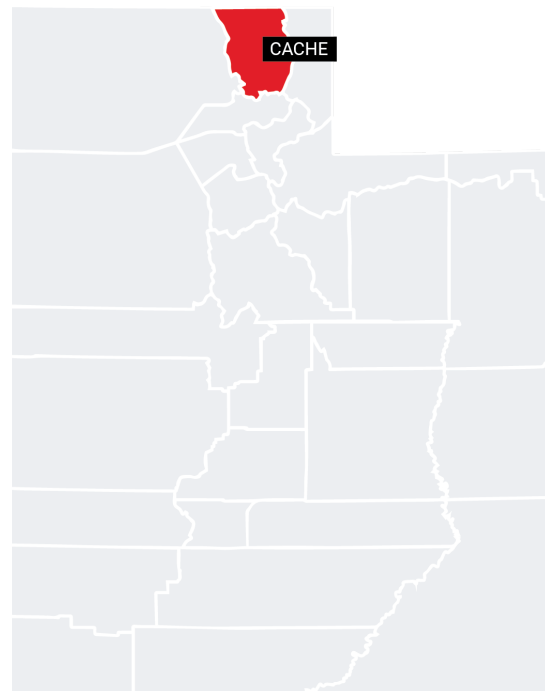
Sample and Results

Introduction

Cache County was sampled for the HERO Project between July 29–August 15, 2020. Testing in Cache County included both blood antibody and nasal swab PCR tests. Results in this section are adjusted using methods consistent with Phase 1 - Part A, which account for a variety of considerations including sampling, nonresponse, demographic balance, and the accuracy of the two clinical tests used. Where available, confidence intervals are presented alongside the adjusted results to provide context for the interpretation.

Cache County Sampling Design

A simple random sample of addresses was used to create a targeted sample group in Cache County. A total of 14,055 households were identified and sent a mailed invitation to participate in the project and complete household and individual surveys. Out of the full sample, 945 households were selected to receive a knock on the door and in-person interview. Households were given different levels of participation incentives to be able to test for and correct for nonresponse bias. Individuals age 12 and older who completed the survey were invited to provide a blood sample for antibody testing.



Survey and Serology Response Rates in Cache County

HERO Project leaders carefully monitored response rates throughout the project to ensure outreach efforts were effective and sampling results were representative of the area. The table below summarizes response rates based on completion of the household survey, individual survey, and individuals who provided a blood serology test. They are listed based on the contact strategy used— either in person and mail or mail only. Household response rate is presented as a ratio of households who either completed the household survey or at least one individual survey. Individual response rates are presented as the proportion of individuals age 12 or older that completed the individual survey. Serology response rates are presented as the proportion of individual survey respondents who also provided a serology sample. The overall response is estimated as the product of the household, individual, and serology level response rates.

	945 Contacted In-Person and by Mail #Responded/Completed	13,110 Mail Only Contact #Responded/Completed
Response		
Household Survey	247	910
Individual	372	1,827
Blood Test	205	1,333
Overall Response Rate	8.9%	4.1%



Cache County Serology Results

The estimated adjusted seroprevalence in Cache County is 2.31%. In other words, about 1 in 42 respondents in Cache County age 12 or older showed evidence of prior infection. The confidence interval for estimated seroprevalence is 0.68%-5.71%. Adjustments for this finding assume the HERO Project derived 0.83 test sensitivity estimate, and the manufacturer's specificity estimate of 0.996.

Clinical Detection Rate

In the 10-17 days prior to blood serology testing for the area, the adjusted zip code case rate for Cache County was 1.63%. Based on this rate and the estimated seroprevalence, the estimated clinical detection rate in Cache County is approximately 70%.

Adjusted Seroprevalence by Population Subgroup

Seroprevalence among the Hispanic community in Cache County is about two times higher than the rest of the county (5.11% compared to 2.31%). When compared to those who identified as Non-Hispanic the rate is even more startling at nearly four times higher (5.11% compared to 1.39%). Estimated seroprevalence in Cache County also appeared to be higher for individuals aged 12 to 45, those who had known contact with a positive individual, and those residing in a house with another seropositive individual. Confidence intervals are not available for the subgroup age 65+ due to the small sample size. The adjusted seroprevalence results account for testing error and include corrections to adjust for nonresponse.

	Total Number	Total Number Seropositive	Adjusted Seroprevalence (%)	Seroprevalence 95% Confidence Interval (%)
Population Subgroup				
Age [12 – 45]	851	13	2.42	0.47-7.41
Age [45 – 65]	385	8	3.23	0.57-11.48
Age [65 +]	302	2	0.32	-
Male	732	9	2.26	0.08-10.66
Female	801	14	2.40	0.38-8.35
Non-Hispanic	1,459	18	1.50	0.07-5.23
Hispanic	72	5	8.80	0.88-44.66
Known contact: No	1,132	10	0.45	0.00-1.74
Known contact: Yes	95	8	16.07	4.21-45.76
Known contact: Don't Know	310	5	4.16	0.00-33.96
Reside in household with another seropositive individual	25	8	70.21	32.85-100.50
Reside in household without a seropositive individual	1,513	15	1.05	0.00-5.04

Prior Positives and PCR Results

Out of the 1,538 individuals who provided a blood sample, 1,340 individuals self-reported they had a prior Covid-19 PCR nasal swab test, and 6 individuals reported a prior positive test result. Further PCR tests found an additional 5 positive individuals out of 23 individuals positive for blood antibodies.

Phase 1 - Part B: Weber County

Sample and Results

Introduction

Rounding out the counties sampled in Part B of Phase 1 was Weber County. Testing in Weber County included both blood antibody and nasal swab PCR tests taken between August 5–14, 2020. Results in this section are adjusted using methods consistent with Phase 1 - Part A, which account for a variety of considerations including sampling, nonresponse, demographic balance, and the accuracy of the two clinical tests used. Confidence intervals are presented alongside the adjusted results to provide context for the interpretation.

Weber County Sampling Design

A simple random sample of addresses was used to create a targeted sample group in Weber County. HERO Project leaders focused on areas with the highest reported incidence of Covid-19 by examining case counts. A total of 11,900 households were identified and sent a mailed invitation to participate in the project and complete household and individual surveys. Out of this sample, 2,700 households were randomly selected to receive an interview knock on the door and complete the survey in person. Households were given different levels of participation incentives to be able to test for and correct for nonresponse bias. Individuals age 12 and older who completed the survey were invited to provide a blood sample for antibody testing.



Survey and Serology Response Rates in Weber County

HERO Project leaders carefully monitored response rates throughout the project to ensure outreach efforts were effective and sampling results were representative of the area. The table below summarizes response rates based on completion of the household survey, individual survey, and individuals who provided a blood serology test. They are listed based on the contact strategy used. Household response rate is presented as a ratio of households who either completed the household survey or at least one individual survey. Individual response rates are presented as the proportion of individuals age 12 or older that completed the individual survey. Serology response rates are presented as the proportion of individual survey respondents who also provided a serology sample. The overall response is estimated as the product of the household, individual, and serology level response rates.

	<div> <div>2,700 Contacted In-Person and by Mail #Responded/Completed</div> <div>9,200 Mail Only Contact #Responded/Completed</div> </div>	
Response		
Household Survey	382	500
Individual	659	1,023
Blood Test	387	832
Overall Response Rate	5.8%	3.8%



Weber County Serology Results

Analysis of the blood antibody tests in Weber County revealed an adjusted seroprevalence of 1.39%, or about 1 in 72 respondents in Weber County age 12 or older showed evidence of prior infection. The confidence interval for estimated seroprevalence is 0.27%-3.66%. Adjustments for this finding assume the HERO Project derived 0.83 test sensitivity estimate, and the manufacturer's specificity estimate of 0.996.

Clinical Detection Rate

In the 10-17 days prior to blood serology testing for the area, the adjusted zip code case rate for Weber County was 0.9%. Based on this rate and the seroprevalence estimate, the estimated clinical detection rate in Weber county is approximately 65%.

Adjusted Seroprevalence by Population Subgroup

Consistent with the findings from Phase 1 - Part A and other national research, seroprevalence appears to be higher for the Hispanic community, with a rate of 2.46%. However, the sample size is too small for clear conclusions. Estimated seroprevalence in Weber County also appeared to be higher for individuals over age 45, those who had known contact with a positive individual, and those residing in a house with another seropositive individual. Confidence intervals are not available for some subgroups due to the small sample size. The adjusted seroprevalence results account for testing error and include corrections to adjust for nonresponse.

	Total Number	Total Number Seropositive	Adjusted Seroprevalence (%)	Seroprevalence 95% Confidence Interval (%)
Population Subgroup				
Age [12 – 45]	581	4	0.07	0.00-3.43
Age [45 – 65]	364	9	3.93	0.65-14.58
Age [65 +]	274	5	2.49	0.16-11.11
Male	563	9	0.76	0.00-2.58
Female	648	9	2.04	0.47-5.6
Non-Hispanic	1,112	16	1.17	0.24-2.69
Hispanic	93	2	2.46	-
Known contact: No	920	9	0.5	0.00-2.07
Known contact: Yes	74	6	14.83	1.42-66.93
Known contact: Don't Know	225	3	1.48	-
Reside in household with another seropositive individual	19	2	29.21	-
Reside in household without a seropositive individual	1,200	16	0.88	0.06-2.15

Prior Positives and PCR Results

Out of the 1,219 individuals who provided a blood sample, 1,003 individuals self-reported they had a prior Covid-19 PCR nasal swab test, and 9 individuals reported a prior positive test result. Further PCR tests found an additional 4 positive individuals out of 18 individuals positive for blood antibodies.

Phase 2: West Salt Lake Sample and Results

Introduction

Phase 2 of the HERO project allows project leaders the opportunity to gain further insight into smaller population clusters, SARS-CoV-2 transmission trends, and longer-term outcomes across the original testing areas. An emerging trend of high case counts in West Salt Lake quickly became a focus area so that community leaders and decision-makers could better support efforts to limit spread in the area. Monitoring hot spots in West Salt Lake and other areas of the state allows insight into transmission rates and susceptible populations. Findings from these areas could stand-out as startling compared to other areas given the desire to test the areas with the highest case counts, and the findings should not be generalized to broader geographic areas. Blood antibody and nasal swab testing in West Salt Lake took place between July 13–August 4, 2020.

This section contains adjusted results using methods described in Phase 1 - Part A. Adjustments account for a variety of considerations including sampling, nonresponse, demographic balance, and the accuracy of the two clinical tests used. Confidence intervals are presented alongside the adjusted results to provide context for the interpretation.

West Salt Lake Sampling Design

Using data from the Utah Department of Health, project leaders pin-pointed small health areas in West Salt Lake with high case counts as of early June 2020. Small health areas were mapped along Census tracts, then a simple random sample of addresses was used to define a targeted sample of 14,060 households. All households within the sample were sent a mail invitation to participate in the project. Out of the larger sample, 1,980 households were randomly selected for an in-person knock on the door and interview. Households were given different levels of participation incentives to be able to test for and correct for nonresponse bias. Those who completed the survey were then asked to provide a blood sample for serology testing.



Survey and Serology Response Rates in West Salt Lake

HERO Project leaders carefully monitored response rates throughout the project to ensure outreach efforts were effective and sampling results were representative of the area. The table below summarizes response rates based on completion of the household survey, individual survey, and individuals who provided a blood serology test. They are listed based on the contact strategy used. Household response rate is presented as a ratio of households who either

completed the household survey or at least one individual survey. Individual response rates are presented as the proportion of individuals age 12 or older that completed the individual survey. Serology response rates are presented as the proportion of individual survey respondents who also provided a serology sample. The overall response is estimated as the product of the household, individual, and serology level response rates.

	1,980 Contacted In-Person and by Mail #Responded/Completed	12,080 Mail Only Contact #Responded/Completed
Response		
Household Survey	432	782
Individual	718	1,465
Blood Test	418	1,208
Overall Response Rate	8.3%	4.2%

West Salt Lake Serology Results

Analysis of the blood antibody tests in West Salt Lake revealed an adjusted seroprevalence of 2.81%, or about 1 in 36 respondents in West Salt Lake age 12 or older showed evidence of prior infection. Reflecting the sampling design, which targeted small areas with high prevalence, this is the highest community-wide seroprevalence found across all HERO testing areas. The confidence interval for estimated seroprevalence is 1.00%-6.36%. Adjustments for this finding assume the HERO Project derived 0.83 test sensitivity estimate, and the manufacturer's specificity estimate of 0.996.



Clinical Detection Rate

In the 10-17 days prior to blood serology testing for the area, the adjusted zip code case rate for West Salt Lake was 1.76%. Based on this rate and the seroprevalence estimate, the estimated clinical detection rate in West Salt Lake is approximately 60%.

Adjusted Seroprevalence by Population Subgroup

Seroprevalence among Hispanic respondents was found to be nearly twice as high compared to community-wide seroprevalence (5.11% compared to 2.81%). Estimated seroprevalence in West Salt Lake also appeared to be higher for individuals aged 12 to 45, those who had known contact with a

positive individual, and those residing in a house with another seropositive individual. A confidence interval is not available for age 65+ due to the small sample size.

	Total Number	Total Number Seropositive	Adjusted Seroprevalence (%)	Seroprevalence 95% Confidence Interval (%)
Population Subgroup				
Age [12 – 45]	918	22	3.38	0.92-9.32
Age [45 – 65]	477	10	1.43	0.16-4.42
Age [65 +]	229	2	2.56	-
Male	728	14	2.92	0.73-8.66
Female	894	20	2.71	1.07-5.76
Non-Hispanic	1,328	21	1.39	0.33-3.22
Hispanic	289	13	5.11	1.19-16.36
Known contact: No	1,150	19	0.87	0.08-2.06
Known contact: Yes	151	11	17.82	5.36-46.45
Known contact: Don't Know	322	4	0.78	0-3.75
Reside in household with another seropositive individual	31	11	83.87	33.83-112.49
Reside in household without a seropositive individual	1,595	23	1.23	0.28-2.9

Prior Positives and PCR Results

Out of the 1,626 individuals who provided a blood sample, 333 individuals self-reported they had a prior Covid-19 PCR nasal swab test, and 13 individuals reported a prior positive test result. Further PCR tests found an additional 13 positive individuals out of 31 individuals positive for blood antibodies.

Phase 2: Early Results of the Longitudinal Analysis

Introduction

The HERO Project's longitudinal analysis was designed to provide a longer-term perspective about community-wide infection rates and virus detection across Utah. Instead of returning to the original project areas and collecting data from a new participant sample, the project returned to the original participants and asked them to update survey responses and provide new samples for active virus and blood antibody tests. This method provides deeper insight about infection incidence during what is now the second half of the pandemic in Utah (mid-June to mid-September) compared to the first three months of the pandemic (mid-March to mid-June).

In addition to providing a broader picture of community spread that can be used to inform public health decision making in Utah, the longitudinal analysis will also be used to support hot spot monitoring in areas with high case counts.

At the time of this report update, results of the longitudinal analysis are still incomplete and do not include all of Utah County. The early findings presented below have not been adjusted for response bias or testing sensitivity and specificity.

Participation in Longitudinal Data Collection

So far, a total of 9,034 original project participants have been asked to provide data for the longitudinal analysis. Out of this sample, 5,878 individuals completed the survey, and 4,911 individuals provided new samples. Below, participation is summarized by municipality or neighborhood within Salt Lake, Davis, and Utah Counties. The median interval between the first and second tests provided by the participants was 110 days, or approximately three to four months.

		Number Contacted	Completed Survey (Number; %)	Provided Blood Sample (Number; %)
County	City / Neighborhood			
Salt Lake County	Daybreak	577	334 (57.9%)	262 (45.4%)
	Sandy	1,809	1,193 (65.9%)	1,034 (57.2%)
	Midvale	1,040	656 (63.1%)	548 (52.7%)
	West Valley	449	291 (64.8%)	243 (54.1%)
	Downtown SLC	881	601 (68.2%)	481 (54.6%)
Davis County	Bountiful	1,085	821 (75.7%)	723 (66.6%)
	Kaysville	949	579 (61%)	471 (49.6%)

Utah County	Spanish Fork	723	468 (64.7%)	383 (53%)
	Orem	1,521	935 (61.5%)	766 (50.4%)
Total		9,034	5,878 (65.1%)	4,911 (54.4%)

Unadjusted Seroconversion and Seroreversion

Seroconversion refers to incidence of individuals who originally tested negative for blood antibodies, and then tested positive for antibodies in a subsequent blood sample. Seroconversion is the most effective way to monitor how infection incidence and the rate of detection has changed in a community. Based on the data collected to date, 1.5% of original study participants (65 individuals) seroconverted, demonstrating a small increase in seroprevalence.

Negative Baseline Sample	Negative Follow-up Sample	Positive Follow-up Sample
4,343	4,278	65
Original project participants with negative antibody tests	98.5% of participants negative for antibodies on the second test	1.5% of participants positive for antibodies on the second test

Seroreversion refers to the opposite occurrence— individuals who originally tested positive for blood antibodies, and then tested negative for antibodies on a subsequent test. Seroreversion rates can be used to account for a loss of antibodies, or the potential loss of virus of immunity across a community. Based on data collected to date, 22% of original participants (10 out of 46 individuals) seroreverted, and tested negative for blood antibodies on their second test.

Positive Baseline Sample	Negative Follow-up Sample	Positive Follow-up Sample
46	10	36
Original project participants with positive antibody tests	22% of participants negative for antibodies on the second test	78% of participants positive for antibodies on the second test

Out of the total sample of 4,389 individuals who provided a second blood sample for the longitudinal analysis, a total of 101 individuals (2.3% of the sample) demonstrated seroprevalence.

Predictors of Seroconversion

Individuals who indicated known contact with others who tested positive for Covid-19 were the most likely to show seroconversion with a rate of 8.1%. Residents of Utah County, individuals age 12 to 18, and Hispanic individuals were also found to be slightly more likely to demonstrate seroconversion.

	Total Number	Total Number Seropositive	% Seroconversion
County / Population Subgroup			
Davis County	1,022	10	1.0%
Salt Lake County	2,262	14	0.6%
Utah County	1,059	41	3.9%
Age [12 – 18]	400	12	3.0%
Age [19 – 25]	264	5	1.9%
Age [26 – 45]	1,447	30	2.1%
Age [45 – 65]	1,298	17	1.3%
Age [66+]	934	1	0.1%
Male	2,002	27	1.3%
Female	2,317	38	1.6%
Nonhispanic	4,089	55	1.3%
Hispanic	215	8	3.7%
Known contact: Yes	381	31	8.1%
Known contact: No	3,338	22	0.7%
Known contact: Don't Know	591	11	1.9%

Early Implications of Longitudinal Results

Based on results from Salt Lake County and Davis County, the overall incidence proportion for Covid-19 infection is probably not statistically different between the first and second halves of the pandemic. Based on analysis to date, the rates of clinical detection have remained steady, indicating consistency in state testing capacity.

Next Steps

The HERO School Project

The goal of the HERO School Project is to provide access to school-based testing for students, faculty, and staff for early detection of SARS-CoV 2 in asymptomatic members of school communities. The purpose is to enhance the safety of school communities by reducing the frequency of transmission and reduce the size of school-based outbreaks. By decreasing these risks in school environments, the state can facilitate greater opportunities for in-person learning. The project will address several unanswered questions:

- How many secondary cases occur after an exposure in a classroom or other school related activity? Does this risk vary by grade, masking, or school learning model (e.g. hybrid, or full in-person)?
- Which groups of students, staff, and teachers are at highest risk of secondary infection?
- What is the likelihood of secondary household transmission for students/staff or teachers who test positive?
- What is the likelihood of infection upon return to school following different quarantine strategies, including 14 days and low-risk return after 7 days? Are even shorter quarantine periods combined with testing acceptable, and what type of testing (antibody or PCR) is most appropriate?
- Does school-wide screening help contain outbreaks prior to implementing a change in learning strategy (e.g., return after a closure or when moving from remote to in-person)?
- What is the detection fraction for a school community based on incident detection of confirmed cases?
- How compliant are students with quarantine?

In collaboration with school districts, local health departments and local school leaders, the HERO Project will arrange for on-site no cost testing at schools. As of mid-October, ten schools (including elementary and high schools) in Davis County are participating, with four testing events held to date. Three private schools in Salt Lake City also plan to participate, and the team is actively developing partnerships with Salt Lake, Jordan and Granite School Districts.

Ongoing Project Activities

- Hot spot monitoring and longitudinal data collection is continuing in Utah County, particularly around the Brigham Young University campus.
- New project activities will continue to provide local information to inform decision making, confirm earlier project findings, and provide new information about Covid-19 detection and transmission in Utah.

In the Next Update

- Look for complete results from the longitudinal analysis and early results of school-based work.

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