

UTAH HERO PROJECT



Tracking Covid-19 to
Inform the Return to Normal



Report Published September 15, 2020

Included in this Report

- HERO Project Phase I - Part A description and summary
- Phase I - Part A key findings
- Timeline for upcoming study activities

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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?

Phase 1 - Part A By the Numbers

10,368

Individuals surveyed in
5,125 households

8,108

Blood antibody tests
analyzed

4

Participating
Utah Counties

82

Hope Corps members in the field
targeting 25,575 households

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.

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.

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

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

Key Findings

Phase 1 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 body 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 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.

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 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, seroprevalence was 0.81%. Comparatively, 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 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 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 study.

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

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

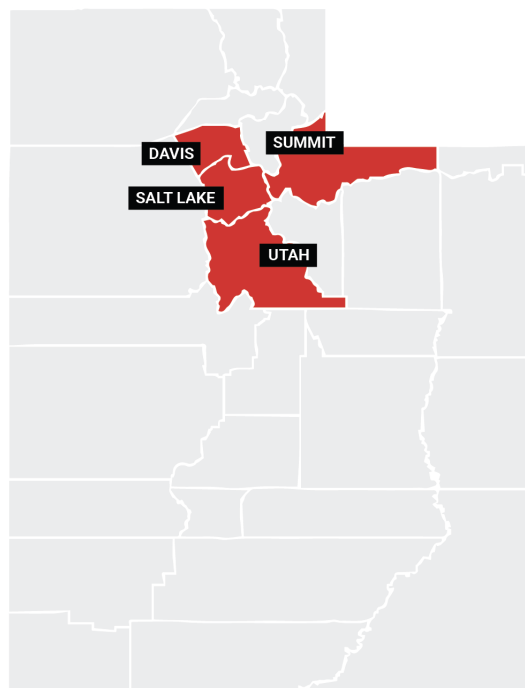
Primary Sampling Design

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 Nonhispanic; 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.

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, and has also been the case 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 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

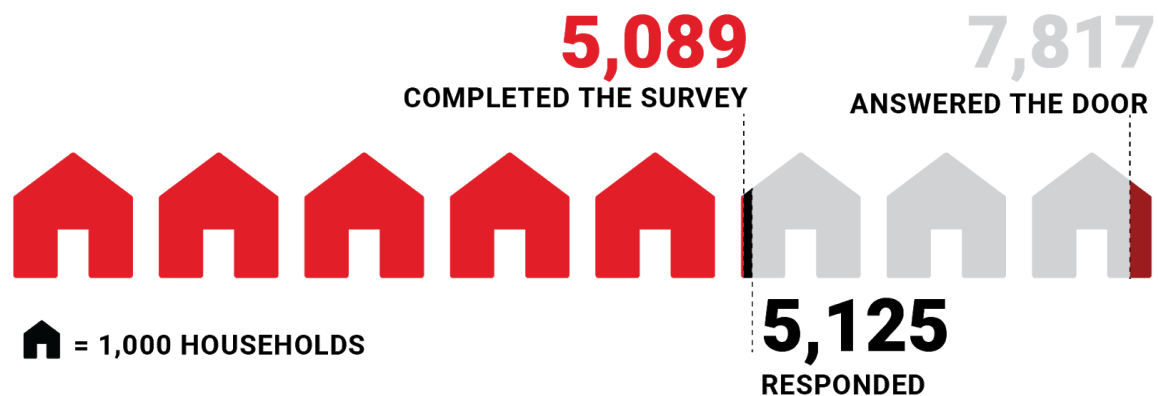
Participants who completed surveys selected a time the following day to complete their tests at a mobile testing site. These sites were established in conveniently located parking lots so participants could drive through and limit their contact with staff. Both nasal swabs and venous blood draws were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

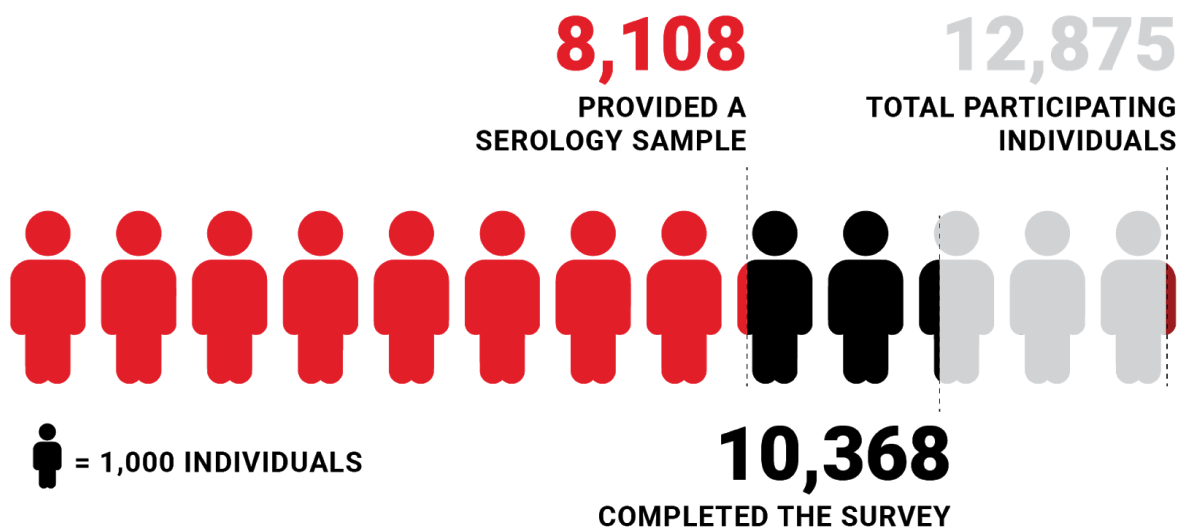
- 5,125 households completed the household survey
- 10,368 individuals completed the individual survey
- 8,108 individuals provided blood tests for serology analysis
- 6,004 individuals were given the PCR nasal swab test

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 assay, or test, for each sample. The accuracy of assays are 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 for Phase 1 based on how many of those participants also tested positive for antibodies. This process changed the sensitivity used in the adjustment from 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 ACCROSS THE 4-COUNTY AREA



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

Primary Seroprevalence Results

Based on the Phase 1 sample, 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 prevalence of COVID-19 among those 12 years and older across the four-county area, and represents roughly 1 in 124 individuals. It is important to interpret this estimate of prevalence in the context of its 95% confidence interval, which reflects 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	95% Confidence Interval
County				
Davis	1,703	16	0.15%	0-1.26
Salt Lake	4,021	38	0.70%	0-1.78
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	0-1.36
Male	0.74	0.05-1.65
Female	0.89	0.17-1.85
Nonhispanic	0.48	0-1.09
Hispanic	2.73	0.62-8.01
Known contact: No	0.41	0-1.12
Known contact: Yes	8.51	3.27-19.66
Known contact: Don't Know	0.24	0-1.47
Reside in household with other seropositive individual	24.88	10.55-49.33
Reside in household without a seropositive individual	0.32	0-0.88

Clinical Detection Rate

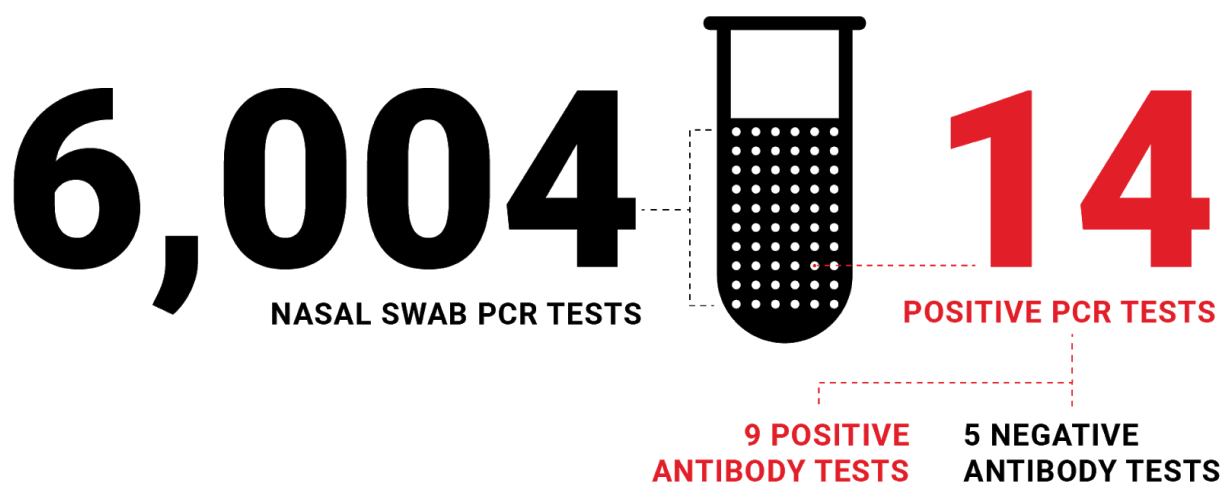
Since not all individuals experiencing symptoms get tested, and some do not experience symptoms, the sampling method used in the project gives an indication of how many active cases are missed. To better understand the rate of clinical detection in the four-county area, HERO Project leaders examined 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 you might expect seroprevalence to look like. By comparing the case count collected in clinical settings to the random sample in Phase 1, 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 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.

Next Steps

Current Project Activities

- Phase 1-Part B county-wide population studies are nearing completion in Cache County, Washington County, and Weber County.
- Phase 2 of the HERO Project includes a closer look at West Salt Lake, where the case count has been higher than surrounding areas.
- Additional projects are underway including longitudinal testing results of project participants and an emphasis on school-based transmission of the virus.
- These new project areas will continue to provide local information to inform decision making, confirm findings from Phase 1, and provide new information about how Covid-19 detection and transmission in Utah.

In the Next Update

- Look for additions to this report describing new analyses from more recent project areas.

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