

Second Progress Report: Development of Resources for Colorado's SARS-CoV-2 Epidemic

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Introduction

With generous support from several sources, the Colorado School of Public Health (ColoradoSPH) has developed two key resources for the State of Colorado, addressing needs of some of the most critical stakeholders involved in epidemic control. The first is an elaboration of the epidemic model used for the statewide modeling to provide estimates for the course of the epidemic in the state's 11 local public health agency (LPHA) regions and in the counties of the Denver Metro Area. The second is the development and implementation of a website (www.colorado-data.org) that provides a picture at the county-level of the epidemic, covering indicators of the status of the epidemic, the demographics and risk profile of the county population, and indicators of economic impact. The website also provides access to the modeling at the LPHA- and county-levels.

About the Colorado School of Public Health

The mission of the Colorado School of Public Health (ColoradoSPH), which is a collaboration among CU Anschutz, CSU, and UNC, is to promote the physical, mental, social, and environmental health of people and communities in the Rocky Mountain Region, across our nation, and globally. This mission is accomplished through collaborations in education, population-based research, and community service that bring together institutions, agencies, and diverse populations. Importantly, our goal is to build a diverse and representative academic community that recognizes the importance of social, economic, health, and environmental justice and that can address health inequities in the state. The activities described in this report are exemplary of how we fill our mission: bringing needed modeling results to all the regions of this large and diverse state and providing data that captures the health and economic status of all groups in Colorado.

COVID-19 Regional- and County-Modeling

In March, 2020, the Colorado COVID-19 Modeling Group was formed as the COVID-19 pandemic first emerged in the state. Over the more than two years since its formation, the team has used an increasingly refined SEIR (Susceptible, Exposed, Infected, Recovered) model to track the pandemic in Colorado. The model estimates are used to characterize the status of the epidemic, i.e., how rapidly is the epidemic spreading, and to make projections of what could happen in coming months under different scenarios of transmission control. The model results are used by the Colorado Department of Public Health and Environment (CDPHE) and the Governor's Office in decision-making.

Some of the key measures provided by the model are:

1. The effective reproduction number (R_e), which describes the rate of transmission. If above 1, the epidemic curve is rising and if below 1, it is falling.
2. Transmission control, which describes the degree to which transmission of infection is being controlled. It ranges from 0 (i.e., no control at all) to 100% (equivalent to complete lockdown).
3. Infection prevalence characterizes how many people are infected in a population. It is expressed as 1 in xx, e.g., 1 in 100 Coloradans, are infected
4. Percent of population immune reflects the percentage of the population that has been infected with the SARS-CoV-2 virus or vaccinated (now to varying levels, depending on the number of inoculations).

The [regional- and county-level models](#) were developed following requests from some critical stakeholders particularly the directors of health departments throughout the state. The regional reports have been temporarily paused as the team refines the approach but will return in the near future. The state-level modeling proved to be too broad for use by the LPHAs, as the model results did not address the specific characteristics of the populations of the state nor the variation in the epidemic by county and geographic region. The regional- and county-level reports are now posted regularly on the website for the Colorado School of Public Health and can also be accessed through the new website described below. The most recent report (06/23/2022) can be found [here](#), and all previous reports can be found [here](#).

The development of these models to complement the statewide model involved substantial effort to accommodate the more limited quantity of data available for these subpopulations of the state. New approaches were developed and tested that pulled in case data as well as hospitalization data, which can be sparse for smaller regions and counties. Additionally, the team developed data displays that provided a comprehensive picture over time for each geographic unit.

Colorado Population Data Dashboard (www.colorado-data.org)

The Colorado School of Public Health and the COVID-19 Modeling Group developed the Colorado Population Data Dashboard website to disseminate key information and population-level data related to the ongoing SARS-CoV-2 (COVID-19) pandemic. It is designed to complement existing information available on the COVID-19 pandemic and provide a comprehensive picture of community-level characteristics to assist local decision-makers in both the short- and long-term recovery post-pandemic.

It brings together data from state and federal public resources on health and economics, epidemic models for the state, local public health regions and counties, Medicaid enrollment, Supplemental Nutrition Assistance Program (SNAP) enrollment, and unemployment activity at the county level.

The three key audiences of the Colorado Population Data Dashboard are:

- I. State and Local elected officials and other decision-makers in the state
- II. ColoradoSPH students and faculty

III. Coloradans generally

The development of this website and the Colorado Population Database has been supported by the Gates Family Foundation, the Colorado Health Foundation, and an anonymous donor. Throughout its development, input was obtained from a diverse group of [stakeholders](#) who will continue to help us improve the website resources into the future.

Colorado Population Database: Data Sources and Indicators

All the datasets and indicators were carefully selected for inclusion in the website with input from our stakeholders. The website provides access to both static (updated on a yearly basis) and real-time (updated on a daily, weekly, or monthly basis) data. We make the data available to all who may choose to use it in their own analyses through the website.

We coordinated with various agencies in Colorado to ensure the accuracy and interpretation of the data including: CDPHE, Colorado State Demography Office, Colorado Department of Labor and Employment, Colorado Department of Health Care Policy and Financing, and Colorado Office of Economic Security.

The website dedicates a series of pages for estimates (e.g., effective reproduction number and infection prevalence) from the [state](#) and [regional epidemic models](#), as described above.

Data sources for the Colorado Population Database include:

- COVID-19 surveillance (test, cases, hospitalizations, deaths, and vaccination):
 - Colorado Department of Public Health and Environment (CDPHE)
- Demographic and socio-economic factors:
 - Colorado State Demography Office
 - United States Census Bureau: American Community Survey 5-Year Estimates
 - Centers for Disease Control & Prevention (CDC): Social Vulnerability Index
- Health risks (co-morbidity):
 - CDPHE: Colorado Behavioral Risk Factor Surveillance System
 - CDC: County-Level Comorbidity Prevalence Estimates; Wide-ranging Online Data for Epidemiologic Research (CDC WONDER) Underlying Cause of Death
 - Centers for Medicare & Medicaid Services (CMS): Chronic Condition Warehouse for Medicare Beneficiaries, Agency for Healthcare Research and Quality (AHRQ): Hospital Cost Utilization Project State Inpatient Database
 - Colorado Center for Improving Value in Health Care (CIVHC): populations at risk for serious illness from COVID-19, and telehealth services utilization
- Unemployment insurance monthly claims: Colorado Department of Labor and Employment
- Medicaid monthly enrollment: Colorado Department of Health Care Policy and Financing
- Supplemental Nutrition Assistance Program (SNAP) monthly enrollment: Colorado Department of Human Services, Office of Economic Security

The website's [county data dashboards](#) include the following categories of indicators:

- COVID-19 surveillance indicators (e.g., past 14-day case rates and positivity rates)
- COVID-19 immunization
- Demographics (e.g., age and race)
- Social and economic factors (e.g., education and insurance)
- Health risks (e.g., diabetes, asthma and heart disease)
- Mental health (e.g., suicide and alcohol consumption)
- Economic activity (e.g., monthly filings for unemployment insurance benefits)
- Public Assistance (e.g., monthly SNAP enrollment and monthly Medicaid enrollment)
- Other factors that may increase a person's and a population's risk for contracting SARS-CoV-2 infection and the disease it causes—COVID-19 (e.g., working in essential jobs)

New Initiatives Since the First Report

a) Research Opportunities for Undergraduate, Master- and Doctoral-Level Students

During Fall 2021, we launched a school-wide initiative, including the Denver campus (undergraduate program in Public Health), to facilitate student-led Colorado-based research that used the Colorado Population Data. The initiative encourages students to use the data in a variety of analyses including capstone projects. We partnered with ColoradoSPH's Faculty Director for Practice-Based Learning, and the University of Denver's College of Liberal Arts and Sciences Director of Undergraduate Studies.

We continue to welcome research projects that:

- 1- Improve our understanding of the health, economic, and social short- and long-term impacts of the pandemic;
- 2- Improve our understanding of the drivers underlying the inequities in how the pandemic has impacted vulnerable groups in terms of health, economic, and social impacts;
- 3- Given the school's emphasis on social, economic, health, and environmental justice, projects addressing these issues are particularly consistent with our mission;
- 4- Engage key community stakeholders to address issues of particular significance to communities;
- 5- Improve the Colorado Data Dashboard based on stakeholder input.

We strongly encourage all students using the Colorado Population Data to engage with local stakeholders as much as possible, and to have a dissemination plan for the study findings within the ColoradoSPH and beyond, including back to key stakeholder groups.

b) Database Updates and Infrastructure

Data updates included:

- Longitudinal American Community Survey data from 2010-2019
- COVID-19 vaccine data

We identified a more sustainable platform to use as the website's data feed. This will improve data accessibility and website functionality.

c) Rocky Mountain Prevention Research Center (RMPRC): CDC COVID-19 Vaccine Supplement

We partnered with RMPRC to disseminate their [COVID-19 vaccine-focused](#) work through the Colorado Population Data Dashboard. Specifically, RMPRC developed a stakeholder map that plots organizations working to increase COVID-19 vaccine uptake in Colorado. The goal of this map is to provide a resource to help individuals and public health partners identify and understand current efforts to increase vaccine uptake in their communities.

RMPRC is one of a network of 26 Prevention Research Centers in the United States to receive one-year, \$500,000 grants aimed at boosting the number of vaccinated people by exploring, identifying, and addressing the reasons for hesitancy.

The purpose of this supplement is to support the implementation of the CDC's COVID-19 vaccine confidence strategy by funding the Connecting Behavioral Science to COVID-19 Vaccine Demand (CBS-CVD) Network, to identify key behavioral insights that will inform effective solutions to increase confidence in COVID-19 vaccines, and ultimately uptake.

d) Meetings with Stakeholders

We met with stakeholders to give updates on the team's work, website, and database. The meetings included:

- June 8th, 2022: Colorado Counties, Inc (county commissioners) and Colorado Human Services Directors Association
- June 16th, 2022: Colorado Association of Local Public Health Officials
- Monthly meetings with the Governor's Office and additional meetings with CDPHE

e) Website Traffic

Since the website's launch in late December 2020, there have been 4,242 unique users. Users spent an average of 2 minutes per visit. Interestingly, the engagement rate (a Google Analytics metric that tracks how actively involved with your content your audience is) was high for most cities in Colorado. User traffic seems to have been higher specially during surges throughout the pandemic (e.g., Delta and Omicron surges).

Google Analytics also shows that the website's data have been downloaded several times.

Anticipated Additions and Initiatives

a) Local Public Health Agencies: Community Health Needs Assessment

We also plan to encourage LPHAs to leverage the database as they complete their state-required community health needs assessments. This is especially important for rural and smaller LPHAs that may not have the resources and personnel to collect the data.

b) Data and Updates

We will continue to enrich the data available on the website. Planned additions include mental health indicators, the new CDC Minority Social Vulnerability Index, and further expansions as we hear from users.

As the pandemic continues to evolve, and hopefully move into an endemic phase, we will continue to adapt the website to keep it relevant for stakeholders.