

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 3/15/22

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 3/15/22 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

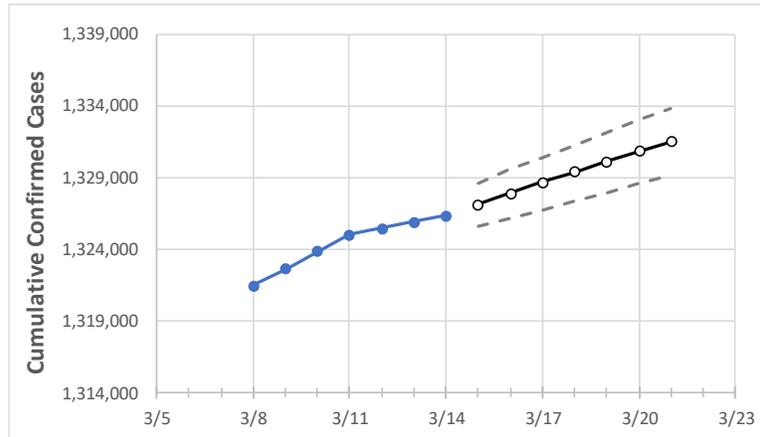
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Colorado State Projections



	Actual Confirmed Cases On:				Projected Cases For:							
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	
Colorado	1,325,063	1,325,506	1,325,948	1,326,391	1,327,165	1,327,944	1,328,673	1,329,416	1,330,143	1,330,868	1,331,543	

Note: The State’s projection shows a “best estimate” curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Colorado Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	
Adams	129,407	129,446	129,484	129,523	129,577	129,632	129,683	129,733	129,784	129,837	129,884	
Arapahoe	147,571	147,624	147,678	147,731	147,785	147,834	147,884	147,933	147,979	148,028	148,071	
Boulder	61,319	61,344	61,370	61,395	61,438	61,478	61,519	61,561	61,602	61,641	61,680	
Denver	165,670	165,734	165,798	165,862	165,939	166,015	166,091	166,162	166,231	166,303	166,370	
Douglas	75,812	75,831	75,850	75,869	75,899	75,927	75,956	75,982	76,009	76,035	76,060	
Eagle	15,711	15,713	15,715	15,717	15,723	15,728	15,733	15,739	15,745	15,750	15,754	
El Paso	180,419	180,484	180,550	180,615	180,728	180,841	180,953	181,057	181,166	181,273	181,375	
Gunnison	3,299	3,302	3,305	3,308	3,311	3,313	3,316	3,319	3,321	3,324	3,326	
Jefferson	119,134	119,162	119,191	119,219	119,283	119,348	119,405	119,464	119,525	119,581	119,638	
Larimer	74,557	74,595	74,633	74,671	74,720	74,770	74,818	74,864	74,908	74,954	74,996	
Pueblo	44,695	44,721	44,748	44,774	44,834	44,895	44,955	45,017	45,075	45,141	45,204	
Weld	81,098	81,115	81,132	81,149	81,190	81,231	81,271	81,308	81,349	81,384	81,419	

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- **Beds:** For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report ([MMWR, March 18, 2020](#)) and state reports of COVID-19 cases.
- **ICU:** The CDC report found that 24% of hospitalized cases require ICU care.
- **Ventilators:** Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.

Colorado Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	3/11	3/12	3/13	3/14	3/16			3/18			3/20					
Adams	129,407	129,446	129,484	129,523	129,632	(25,926)	[6,222]	{3,111}	129,733	(25,947)	[6,227]	{3,114}	129,837	(25,967)	[6,232]	{3,116}
Arapahoe	147,571	147,624	147,678	147,731	147,834	(29,567)	[7,096]	{3,548}	147,933	(29,587)	[7,101]	{3,550}	148,028	(29,606)	[7,105]	{3,553}
Boulder	61,319	61,344	61,370	61,395	61,478	(12,296)	[2,951]	{1,475}	61,561	(12,312)	[2,955]	{1,477}	61,641	(12,328)	[2,959]	{1,479}
Denver	165,670	165,734	165,798	165,862	166,015	(33,203)	[7,969]	{3,984}	166,162	(33,232)	[7,976]	{3,988}	166,303	(33,261)	[7,983]	{3,991}
Douglas	75,812	75,831	75,850	75,869	75,927	(15,185)	[3,645]	{1,822}	75,982	(15,196)	[3,647]	{1,824}	76,035	(15,207)	[3,650]	{1,825}
Eagle	15,711	15,713	15,715	15,717	15,728	(3,146)	[755]	{377}	15,739	(3,148)	[755]	{378}	15,750	(3,150)	[756]	{378}
El Paso	180,419	180,484	180,550	180,615	180,841	(36,168)	[8,680]	{4,340}	181,057	(36,211)	[8,691]	{4,345}	181,273	(36,255)	[8,701]	{4,351}
Gunnison	3,299	3,302	3,305	3,308	3,313	(663)	[159]	{80}	3,319	(664)	[159]	{80}	3,324	(665)	[160]	{80}
Jefferson	119,134	119,162	119,191	119,219	119,348	(23,870)	[5,729]	{2,864}	119,464	(23,893)	[5,734]	{2,867}	119,581	(23,916)	[5,740]	{2,870}
Larimer	74,557	74,595	74,633	74,671	74,770	(14,954)	[3,589]	{1,794}	74,864	(14,973)	[3,593]	{1,797}	74,954	(14,991)	[3,598]	{1,799}
Pueblo	44,695	44,721	44,748	44,774	44,895	(8,979)	[2,155]	{1,077}	45,017	(9,003)	[2,161]	{1,080}	45,141	(9,028)	[2,167]	{1,083}
Weld	81,098	81,115	81,132	81,149	81,231	(16,246)	[3,899]	{1,950}	81,308	(16,262)	[3,903]	{1,951}	81,384	(16,277)	[3,906]	{1,953}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.