

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 9/22/21**

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 9/22/21 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.**

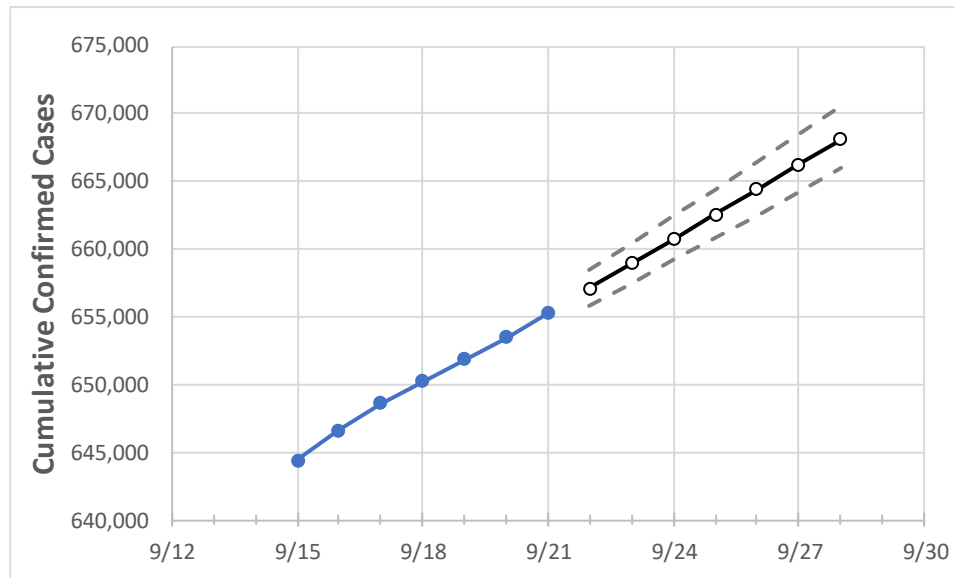
**IEM's Modeling Lead**

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Colorado	650,250	651,857	653,465	655,244	657,077	658,919	660,737	662,562	664,405	666,243	668,085

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Adams	69,236	69,378	69,520	69,634	69,774	69,912	70,050	70,186	70,321	70,458	70,593
Arapahoe	72,212	72,349	72,487	72,619	72,772	72,925	73,076	73,223	73,374	73,525	73,673
Boulder	27,816	27,872	27,929	27,972	28,041	28,109	28,175	28,242	28,310	28,377	28,444
Denver	83,898	84,055	84,212	84,340	84,507	84,670	84,836	85,003	85,170	85,336	85,502
Douglas	36,133	36,225	36,316	36,438	36,547	36,652	36,759	36,863	36,970	37,077	37,183
Eagle	7,726	7,736	7,747	7,769	7,789	7,810	7,828	7,848	7,868	7,887	7,905
El Paso	88,196	88,457	88,717	89,034	89,350	89,663	89,985	90,300	90,619	90,942	91,265
Gunnison	1,681	1,686	1,691	1,694	1,701	1,708	1,715	1,721	1,729	1,735	1,743
Jefferson	56,352	56,505	56,659	56,937	57,123	57,316	57,507	57,703	57,904	58,106	58,317
Larimer	33,874	33,986	34,098	34,177	34,293	34,408	34,523	34,640	34,754	34,871	34,985
Pueblo	21,880	21,928	21,977	22,041	22,105	22,171	22,236	22,303	22,370	22,439	22,510
Weld	40,329	40,468	40,608	40,709	40,857	41,001	41,147	41,292	41,438	41,583	41,733

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:							
	9/18	9/19	9/20	9/21	9/23		9/25		9/27			
Adams	69,236	69,378	69,520	69,634	69,912	{13,982}	[3,356]	{1,678}	70,186	{14,037}	[3,369]	{1,684}
Arapahoe	72,212	72,349	72,487	72,619	72,925	{14,585}	[3,500]	{1,750}	73,223	{14,645}	[3,515]	{1,757}
Boulder	27,816	27,872	27,929	27,972	28,109	{5,622}	[1,349]	{675}	28,242	{5,648}	[1,356]	{678}
Denver	83,898	84,055	84,212	84,340	84,670	{16,934}	[4,064]	{2,032}	85,003	{17,001}	[4,080]	{2,040}
Douglas	36,133	36,225	36,316	36,438	36,652	{7,330}	[1,759]	{880}	36,863	{7,373}	[1,769]	{885}
Eagle	7,726	7,736	7,747	7,769	7,810	{1,562}	[375]	{187}	7,848	{1,570}	[377]	{188}
El Paso	88,196	88,457	88,717	89,034	89,663	{17,933}	[4,304]	{2,152}	90,300	{18,060}	[4,334]	{2,167}
Gunnison	1,681	1,686	1,691	1,694	1,708	{342}	[82]	{41}	1,721	{344}	[83]	{41}
Jefferson	56,352	56,505	56,659	56,937	57,316	{11,463}	[2,751]	{1,376}	57,703	{11,541}	[2,770]	{1,385}
Larimer	33,874	33,986	34,098	34,177	34,408	{6,882}	[1,652]	{826}	34,640	{6,928}	[1,663]	{831}
Pueblo	21,880	21,928	21,977	22,041	22,171	{4,434}	[1,064]	{532}	22,303	{4,461}	[1,071]	{535}
Weld	40,329	40,468	40,608	40,709	41,001	{8,200}	[1,968]	{984}	41,292	{8,258}	[1,982]	{991}
									41,583	{8,317}	[1,996]	{998}

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