

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

Date: 9/27/21

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 9/27/21 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.

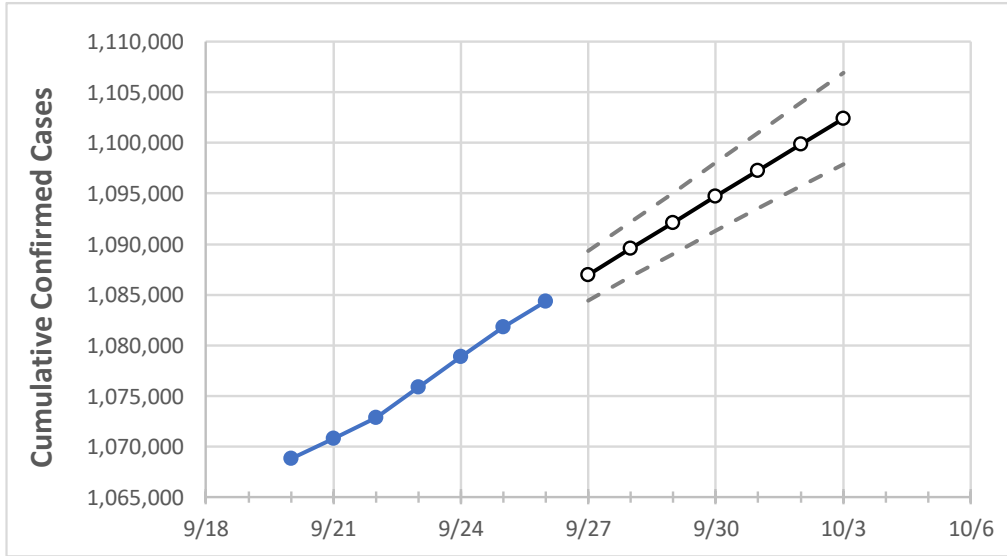
IEM's Modeling Lead

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.

Arizona State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Arizona	1,075,876	1,078,874	1,081,790	1,084,369	1,086,940	1,089,526	1,092,111	1,094,679	1,097,275	1,099,861	1,102,398

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.

Arizona Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Coconino	21,015	21,061	21,113	21,169	21,221	21,273	21,325	21,378	21,431	21,486	21,538
Maricopa	682,553	684,566	686,516	688,491	690,159	691,850	693,492	695,186	696,903	698,574	700,261
Navajo	19,440	19,469	19,496	19,529	19,568	19,609	19,650	19,691	19,732	19,774	19,816
Pima	133,375	133,750	134,104	134,278	134,534	134,793	135,046	135,302	135,562	135,825	136,086
Pinal	67,587	67,752	67,911	67,986	68,176	68,367	68,561	68,755	68,952	69,144	69,343

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.

Arizona Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	9/23	9/24	9/25	9/26	9/28				9/30				10/2			
Coconino	21,015	21,061	21,113	21,169	21,273	(4,255)	[1,021]	{511}	21,378	(4,276)	[1,026]	{513}	21,486	(4,297)	[1,031]	{516}
Maricopa	682,553	684,566	686,516	688,491	691,850	(138,370)	[33,209]	{16,604}	695,186	(139,037)	[33,369]	{16,684}	698,574	(139,715)	[33,532]	{16,766}
Navajo	19,440	19,469	19,496	19,529	19,609	(3,922)	[941]	{471}	19,691	(3,938)	[945]	{473}	19,774	(3,955)	[949]	{475}
Pima	133,375	133,750	134,104	134,278	134,793	(26,959)	[6,470]	{3,235}	135,302	(27,060)	[6,495]	{3,247}	135,825	(27,165)	[6,520]	{3,260}
Pinal	67,587	67,752	67,911	67,986	68,367	(13,673)	[3,282]	{1,641}	68,755	(13,751)	[3,300]	{1,650}	69,144	(13,829)	[3,319]	{1,659}

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.