

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

Date: 5/14/21

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 5/14/21 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.

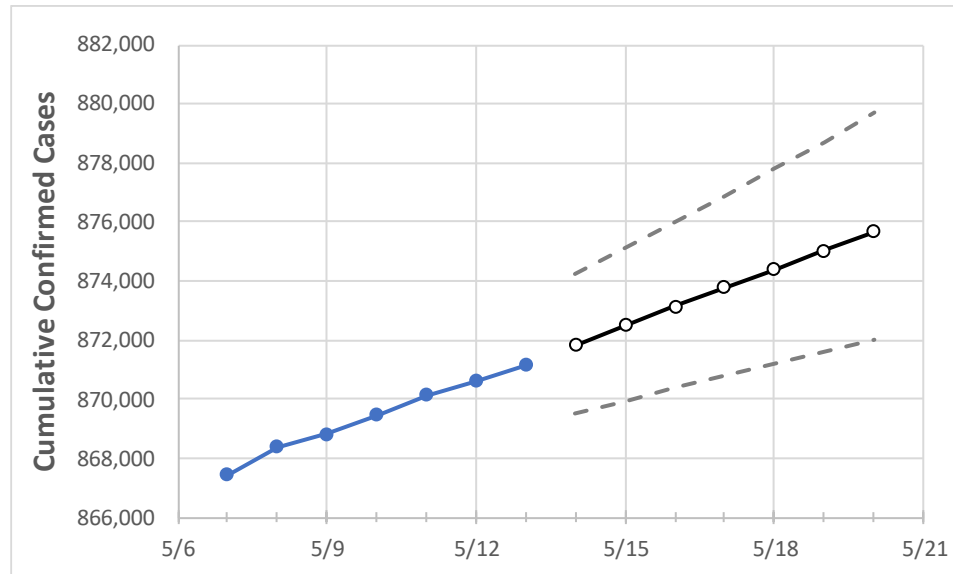
IEM's Modeling Lead

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:							
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	
Arizona	869,472	870,155	870,624	871,168	871,834	872,488	873,134	873,773	874,400	875,022	875,670	

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:							
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	
Coconino	17,851	17,863	17,872	17,874	17,883	17,892	17,901	17,909	17,918	17,926	17,934	
Maricopa	542,072	542,486	542,856	543,198	543,684	544,153	544,618	545,093	545,559	546,029	546,510	
Navajo	16,297	16,309	16,312	16,321	16,331	16,340	16,350	16,360	16,370	16,380	16,390	
Pima	115,805	115,872	115,830	115,905	115,962	116,018	116,076	116,130	116,183	116,237	116,296	
Pinal	51,875	51,934	51,979	52,040	52,093	52,146	52,199	52,255	52,311	52,365	52,420	

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:											
	5/10	5/11	5/12	5/13	5/15				5/17				5/19			
Coconino	17,851	17,863	17,872	17,874	17,892	(3,578)	[859]	{429}	17,909	(3,582)	[860]	{430}	17,926	(3,585)	[860]	{430}
Maricopa	542,072	542,486	542,856	543,198	544,153	(108,831)	[26,119]	{13,060}	545,093	(109,019)	[26,164]	{13,082}	546,029	(109,206)	[26,209]	{13,105}
Navajo	16,297	16,309	16,312	16,321	16,340	(3,268)	[784]	{392}	16,360	(3,272)	[785]	{393}	16,380	(3,276)	[786]	{393}
Pima	115,805	115,872	115,830	115,905	116,018	(23,204)	[5,569]	{2,784}	116,130	(23,226)	[5,574]	{2,787}	116,237	(23,247)	[5,579]	{2,790}
Pinal	51,875	51,934	51,979	52,040	52,146	(10,429)	[2,503]	{1,252}	52,255	(10,451)	[2,508]	{1,254}	52,365	(10,473)	[2,514]	{1,257}

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.