

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

Date: 3/18/22

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 3/18/22 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.

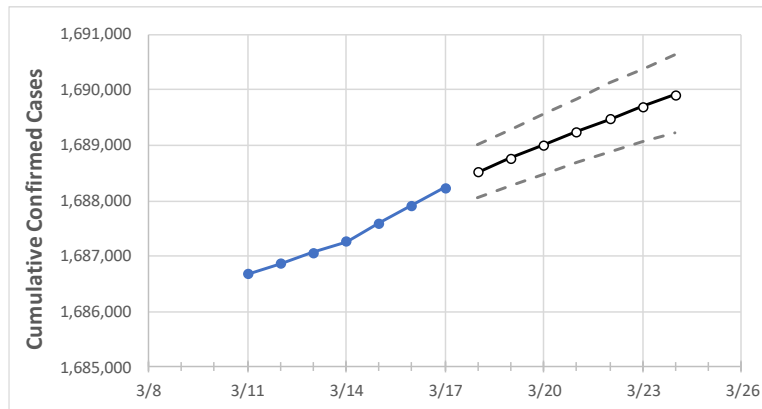
IEM's Modeling Lead

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.

Indiana State Projections



	Actual Confirmed Cases On:				Projected Cases For:							
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	
Indiana	1,687,268	1,687,591	1,687,920	1,688,240	1,688,515	1,688,765	1,689,009	1,689,245	1,689,475	1,689,700	1,689,913	

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.

Indiana Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24	
Decatur	6,983	6,984	6,985	6,988	6,989	6,989	6,990	6,990	6,991	6,992	6,992	
Hamilton	81,497	81,507	81,522	81,535	81,551	81,565	81,580	81,592	81,607	81,620	81,632	
Hendricks	40,642	40,645	40,648	40,652	40,656	40,659	40,662	40,665	40,668	40,671	40,673	
Johnson	42,174	42,178	42,182	42,193	42,197	42,202	42,206	42,210	42,214	42,218	42,222	
Lake	105,703	105,726	105,753	105,780	105,800	105,819	105,837	105,856	105,874	105,892	105,909	
Madison	32,560	32,564	32,570	32,581	32,586	32,590	32,594	32,598	32,603	32,607	32,610	
Marion	224,215	224,244	224,274	224,304	224,354	224,405	224,459	224,505	224,555	224,600	224,645	
St. Joseph	70,338	70,352	70,375	70,379	70,389	70,397	70,406	70,414	70,422	70,430	70,437	

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.

Indiana Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	3/14	3/15	3/16	3/17	3/19				3/21				3/23			
Decatur	6,983	6,984	6,985	6,988	6,989	(1,398)	[335]	{168}	6,990	(1,398)	[336]	{168}	6,992	(1,398)	[336]	{168}
Hamilton	81,497	81,507	81,522	81,535	81,565	(16,313)	[3,915]	{1,958}	81,592	(16,318)	[3,916]	{1,958}	81,620	(16,324)	[3,918]	{1,959}
Hendricks	40,642	40,645	40,648	40,652	40,659	(8,132)	[1,952]	{976}	40,665	(8,133)	[1,952]	{976}	40,671	(8,134)	[1,952]	{976}
Johnson	42,174	42,178	42,182	42,193	42,202	(8,440)	[2,026]	{1,013}	42,210	(8,442)	[2,026]	{1,013}	42,218	(8,444)	[2,026]	{1,013}
Lake	105,703	105,726	105,753	105,780	105,819	(21,164)	[5,079]	{2,540}	105,856	(21,171)	[5,081]	{2,541}	105,892	(21,178)	[5,083]	{2,541}
Madison	32,560	32,564	32,570	32,581	32,590	(6,518)	[1,564]	{782}	32,598	(6,520)	[1,565]	{782}	32,607	(6,521)	[1,565]	{783}
Marion	224,215	224,244	224,274	224,304	224,405	(44,881)	[10,771]	{5,386}	224,505	(44,901)	[10,776]	{5,388}	224,600	(44,920)	[10,781]	{5,390}
St. Joseph	70,338	70,352	70,375	70,379	70,397	(14,079)	[3,379]	{1,690}	70,414	(14,083)	[3,380]	{1,690}	70,430	(14,086)	[3,381]	{1,690}

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.