

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

Date: 4/29/21

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 4/29/21 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.

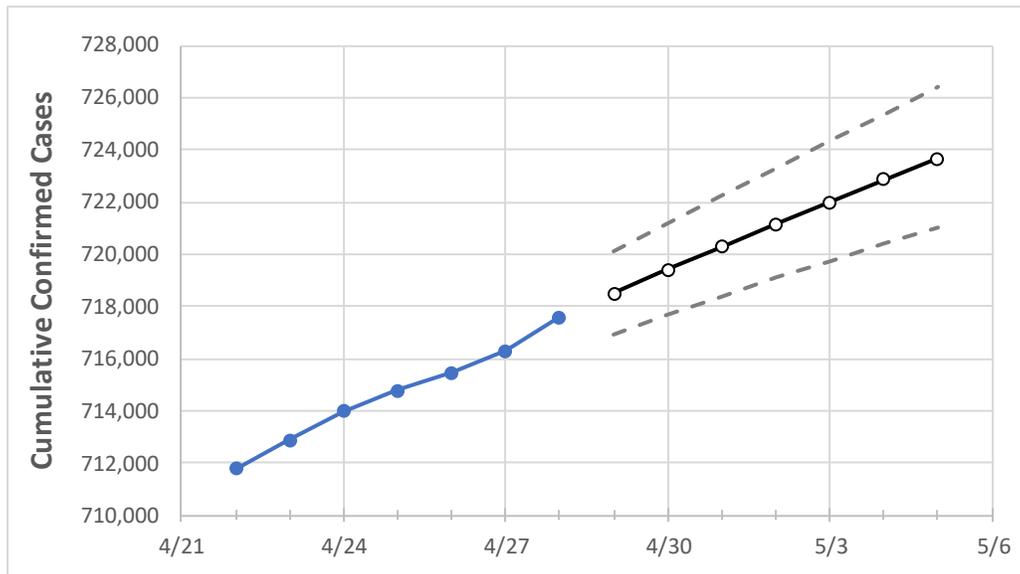
IEM's Modeling Lead

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.

Indiana State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
Indiana	714,786	715,468	716,306	717,564	718,490	719,396	720,272	721,150	722,006	722,863	723,672

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
Decatur	2,810	2,811	2,810	2,812	2,815	2,818	2,821	2,824	2,827	2,831	2,834
Hamilton	34,891	34,928	34,971	35,031	35,083	35,134	35,186	35,236	35,286	35,336	35,385
Hendricks	16,913	16,921	16,935	16,965	16,979	16,993	17,006	17,019	17,032	17,044	17,056
Johnson	17,648	17,659	17,674	17,701	17,717	17,733	17,748	17,763	17,778	17,792	17,805
Lake	52,313	52,386	52,471	52,570	52,665	52,762	52,857	52,948	53,043	53,137	53,231
Madison	12,401	12,407	12,417	12,434	12,441	12,448	12,455	12,462	12,469	12,475	12,481
Marion	97,442	97,552	97,689	97,851	97,982	98,114	98,241	98,367	98,493	98,618	98,740
St. Joseph	34,642	34,701	34,747	34,824	34,892	34,958	35,022	35,086	35,148	35,207	35,265

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:											
	4/25	4/26	4/27	4/28	4/30				5/2				5/4			
Decatur	2,810	2,811	2,810	2,812	2,818	(564)	[135]	{68}	2,824	(565)	[136]	{68}	2,831	(566)	[136]	{68}
Hamilton	34,891	34,928	34,971	35,031	35,134	(7,027)	[1,686]	{843}	35,236	(7,047)	[1,691]	{846}	35,336	(7,067)	[1,696]	{848}
Hendricks	16,913	16,921	16,935	16,965	16,993	(3,399)	[816]	{408}	17,019	(3,404)	[817]	{408}	17,044	(3,409)	[818]	{409}
Johnson	17,648	17,659	17,674	17,701	17,733	(3,547)	[851]	{426}	17,763	(3,553)	[853]	{426}	17,792	(3,558)	[854]	{427}
Lake	52,313	52,386	52,471	52,570	52,762	(10,552)	[2,533]	{1,266}	52,948	(10,590)	[2,542]	{1,271}	53,137	(10,627)	[2,551]	{1,275}
Madison	12,401	12,407	12,417	12,434	12,448	(2,490)	[598]	{299}	12,462	(2,492)	[598]	{299}	12,475	(2,495)	[599]	{299}
Marion	97,442	97,552	97,689	97,851	98,114	(19,623)	[4,709]	{2,355}	98,367	(19,673)	[4,722]	{2,361}	98,618	(19,724)	[4,734]	{2,367}
St. Joseph	34,642	34,701	34,747	34,824	34,958	(6,992)	[1,678]	{839}	35,086	(7,017)	[1,684]	{842}	35,207	(7,041)	[1,690]	{845}

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.