

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

Date: 2/11/22

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 2/11/22 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.

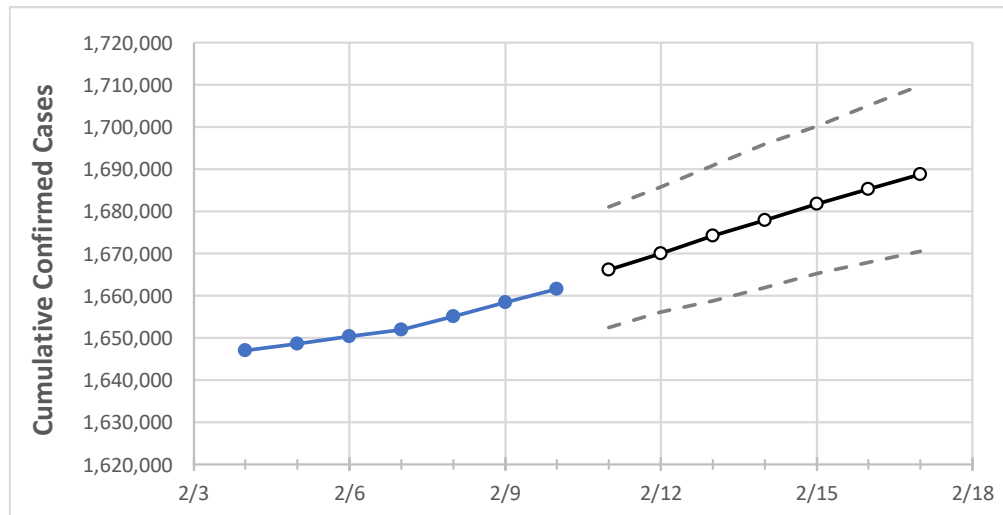
IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Indiana	1,651,981	1,655,125	1,658,344	1,661,563	1,666,129	1,670,054	1,674,191	1,677,916	1,681,694	1,685,225	1,688,752

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Decatur	6,811	6,826	6,844	6,861	6,891	6,921	6,949	6,975	7,003	7,030	7,055
Hamilton	79,719	79,835	79,959	80,083	80,268	80,436	80,599	80,760	80,902	81,050	81,192
Hendricks	39,888	39,946	40,014	40,082	40,173	40,258	40,334	40,409	40,479	40,554	40,617
Johnson	41,502	41,565	41,616	41,667	41,745	41,824	41,893	41,964	42,028	42,093	42,154
Lake	104,397	104,498	104,591	104,684	104,776	104,870	104,960	105,044	105,126	105,204	105,276
Madison	31,902	31,954	32,018	32,082	32,148	32,215	32,280	32,336	32,393	32,450	32,502
Marion	220,553	220,854	221,109	221,364	221,741	222,081	222,439	222,759	223,072	223,394	223,665
St. Joseph	69,257	69,332	69,427	69,521	69,654	69,781	69,905	70,016	70,125	70,236	70,342

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:											
	2/7	2/8	2/9	2/10	2/12				2/14				2/16			
Decatur	6,811	6,826	6,844	6,861	6,921	(1,384)	[332]	{166}	6,975	(1,395)	[335]	{167}	7,030	(1,406)	[337]	{169}
Hamilton	79,719	79,835	79,959	80,083	80,436	(16,087)	[3,861]	{1,930}	80,760	(16,152)	[3,876]	{1,938}	81,050	(16,210)	[3,890]	{1,945}
Hendricks	39,888	39,946	40,014	40,082	40,258	(8,052)	[1,932]	{966}	40,409	(8,082)	[1,940]	{970}	40,554	(8,111)	[1,947]	{973}
Johnson	41,502	41,565	41,616	41,667	41,824	(8,365)	[2,008]	{1,004}	41,964	(8,393)	[2,014]	{1,007}	42,093	(8,419)	[2,020]	{1,010}
Lake	104,397	104,498	104,591	104,684	104,870	(20,974)	[5,034]	{2,517}	105,044	(21,009)	[5,042]	{2,521}	105,204	(21,041)	[5,050]	{2,525}
Madison	31,902	31,954	32,018	32,082	32,215	(6,443)	[1,546]	{773}	32,336	(6,467)	[1,552]	{776}	32,450	(6,490)	[1,558]	{779}
Marion	220,553	220,854	221,109	221,364	222,081	(44,416)	[10,660]	{5,330}	222,759	(44,552)	[10,692]	{5,346}	223,394	(44,679)	[10,723]	{5,361}
St. Joseph	69,257	69,332	69,427	69,521	69,781	(13,956)	[3,349]	{1,675}	70,016	(14,003)	[3,361]	{1,680}	70,236	(14,047)	[3,371]	{1,686}

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.