

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/29/21**

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 12/29/21 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.

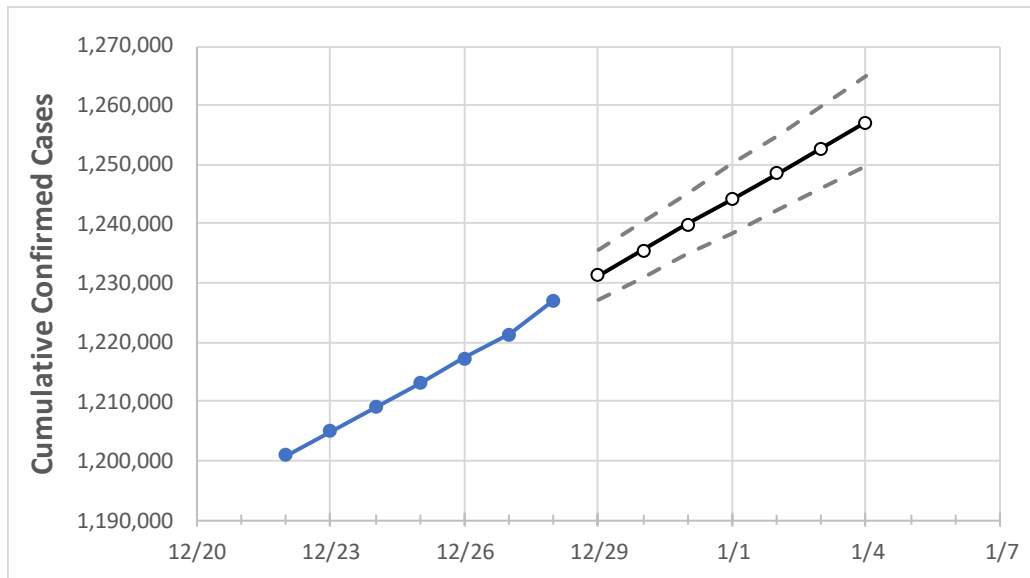
IEM's Modeling Lead

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:							
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	
Indiana	1,213,149	1,217,223	1,221,297	1,227,005	1,231,331	1,235,573	1,239,861	1,244,202	1,248,522	1,252,810	1,257,096	

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:							
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	
Decatur	5,061	5,070	5,079	5,106	5,125	5,144	5,162	5,180	5,198	5,218	5,239	
Hamilton	55,859	56,101	56,344	56,639	56,898	57,163	57,429	57,702	57,979	58,257	58,535	
Hendricks	28,425	28,527	28,629	28,736	28,833	28,931	29,026	29,125	29,223	29,320	29,416	
Johnson	29,896	29,998	30,101	30,264	30,378	30,491	30,605	30,721	30,836	30,953	31,069	
Lake	80,415	81,027	81,640	82,312	83,005	83,744	84,519	85,336	86,176	87,055	87,975	
Madison	23,175	23,264	23,352	23,473	23,566	23,661	23,755	23,849	23,943	24,038	24,131	
Marion	156,807	157,470	158,134	159,230	160,002	160,773	161,587	162,406	163,254	164,114	164,980	
St. Joseph	54,151	54,296	54,441	54,666	54,822	54,974	55,121	55,269	55,413	55,556	55,700	

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:											
	12/25	12/26	12/27	12/28	12/30				1/1				1/3			
Decatur	5,061	5,070	5,079	5,106	5,144	(1,029)	[247]	{123}	5,180	(1,036)	[249]	{124}	5,218	(1,044)	[250]	{125}
Hamilton	55,859	56,101	56,344	56,639	57,163	(11,433)	[2,744]	{1,372}	57,702	(11,540)	[2,770]	{1,385}	58,257	(11,651)	[2,796]	{1,398}
Hendricks	28,425	28,527	28,629	28,736	28,931	(5,786)	[1,389]	{694}	29,125	(5,825)	[1,398]	{699}	29,320	(5,864)	[1,407]	{704}
Johnson	29,896	29,998	30,101	30,264	30,491	(6,098)	[1,464]	{732}	30,721	(6,144)	[1,475]	{737}	30,953	(6,191)	[1,486]	{743}
Lake	80,415	81,027	81,640	82,312	83,744	(16,749)	[4,020]	{2,010}	85,336	(17,067)	[4,096]	{2,048}	87,055	(17,411)	[4,179]	{2,089}
Madison	23,175	23,264	23,352	23,473	23,661	(4,732)	[1,136]	{568}	23,849	(4,770)	[1,145]	{572}	24,038	(4,808)	[1,154]	{577}
Marion	156,807	157,470	158,134	159,230	160,773	(32,155)	[7,717]	{3,859}	162,406	(32,481)	[7,795]	{3,898}	164,114	(32,823)	[7,877]	{3,939}
St. Joseph	54,151	54,296	54,441	54,666	54,974	(10,995)	[2,639]	{1,319}	55,269	(11,054)	[2,653]	{1,326}	55,556	(11,111)	[2,667]	{1,333}

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.