

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

Date: 4/22/21

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 4/22/21 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.

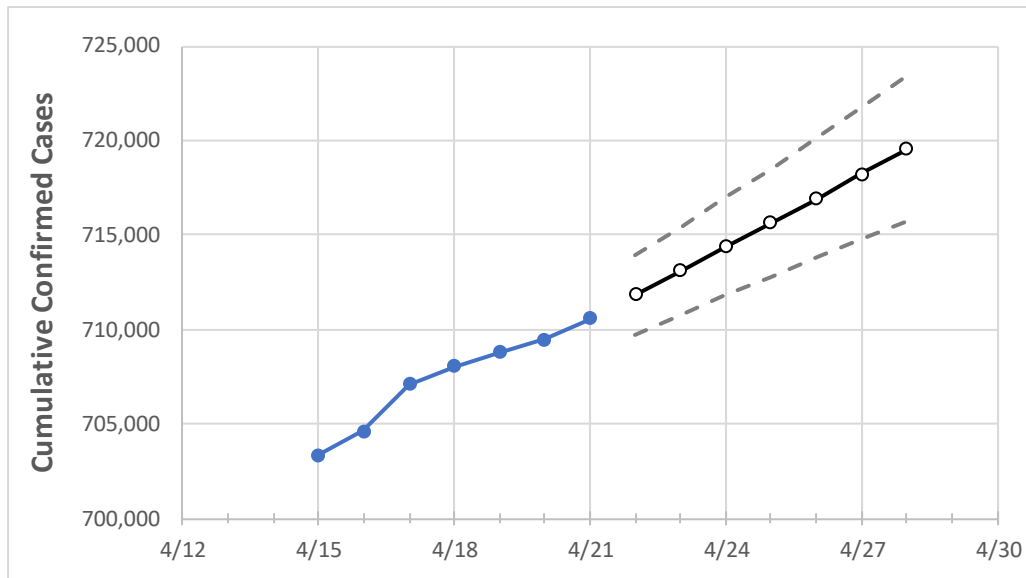
IEM's Modeling Lead

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:							
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	
Indiana	708,067	708,779	709,455	710,607	711,870	713,135	714,386	715,645	716,917	718,225	719,534	

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:							
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	
Decatur	2,789	2,790	2,791	2,795	2,796	2,798	2,799	2,801	2,802	2,804	2,805	
Hamilton	34,497	34,549	34,580	34,643	34,705	34,769	34,833	34,897	34,960	35,029	35,096	
Hendricks	16,803	16,822	16,837	16,854	16,873	16,891	16,909	16,927	16,946	16,964	16,981	
Johnson	17,526	17,544	17,556	17,571	17,593	17,615	17,636	17,658	17,679	17,699	17,720	
Lake	51,704	51,761	51,824	51,908	52,024	52,144	52,265	52,388	52,516	52,646	52,777	
Madison	12,350	12,353	12,358	12,367	12,380	12,393	12,406	12,419	12,431	12,444	12,457	
Marion	96,488	96,619	96,700	96,858	97,036	97,213	97,391	97,574	97,757	97,942	98,128	
St. Joseph	34,075	34,157	34,207	34,306	34,400	34,494	34,586	34,679	34,776	34,869	34,962	

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:											
	4/18	4/19	4/20	4/21	4/23				4/25				4/27			
Decatur	2,789	2,790	2,791	2,795	2,798	(560)	[134]	{67}	2,801	(560)	[134]	{67}	2,804	(561)	[135]	{67}
Hamilton	34,497	34,549	34,580	34,643	34,769	(6,954)	[1,669]	{834}	34,897	(6,979)	[1,675]	{838}	35,029	(7,006)	[1,681]	{841}
Hendricks	16,803	16,822	16,837	16,854	16,891	(3,378)	[811]	{405}	16,927	(3,385)	[813]	{406}	16,964	(3,393)	[814]	{407}
Johnson	17,526	17,544	17,556	17,571	17,615	(3,523)	[846]	{423}	17,658	(3,532)	[848]	{424}	17,699	(3,540)	[850]	{425}
Lake	51,704	51,761	51,824	51,908	52,144	(10,429)	[2,503]	{1,251}	52,388	(10,478)	[2,515]	{1,257}	52,646	(10,529)	[2,527]	{1,264}
Madison	12,350	12,353	12,358	12,367	12,393	(2,479)	[595]	{297}	12,419	(2,484)	[596]	{298}	12,444	(2,489)	[597]	{299}
Marion	96,488	96,619	96,700	96,858	97,213	(19,443)	[4,666]	{2,333}	97,574	(19,515)	[4,684]	{2,342}	97,942	(19,588)	[4,701]	{2,351}
St. Joseph	34,075	34,157	34,207	34,306	34,494	(6,899)	[1,656]	{828}	34,679	(6,936)	[1,665]	{832}	34,869	(6,974)	[1,674]	{837}

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.