

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

Date: 5/12/21

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 5/12/21 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.

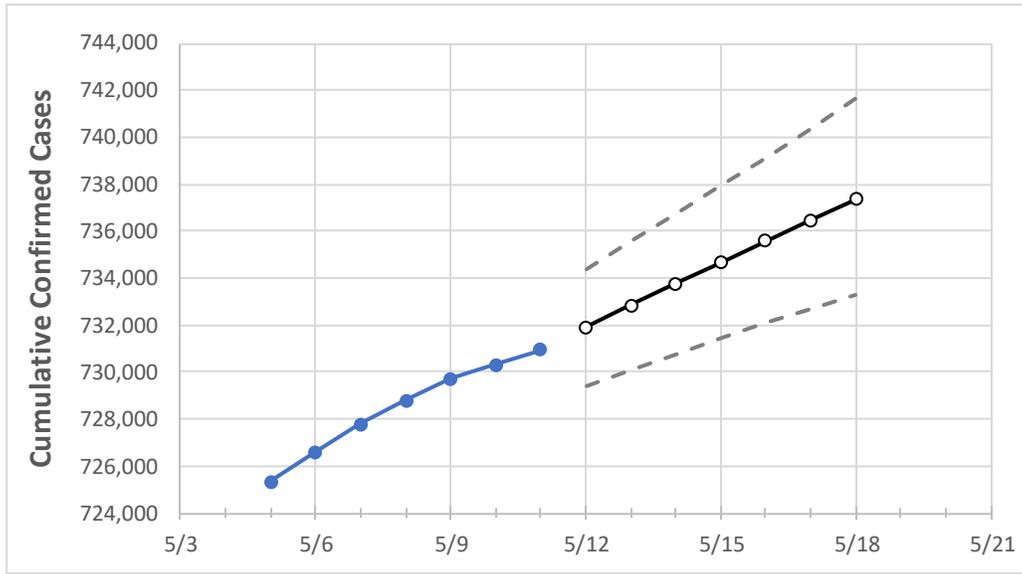
IEM's Modeling Lead

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:							
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	
Indiana	728,811	729,716	730,306	730,969	731,917	732,846	733,780	734,670	735,579	736,475	737,351	

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:							
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	
Decatur	2,847	2,848	2,852	2,854	2,858	2,861	2,865	2,869	2,873	2,877	2,881	
Hamilton	35,536	35,569	35,597	35,629	35,666	35,701	35,737	35,771	35,803	35,836	35,867	
Hendricks	17,199	17,209	17,227	17,244	17,265	17,287	17,308	17,330	17,351	17,373	17,394	
Johnson	17,923	17,933	17,952	17,970	17,990	18,010	18,030	18,049	18,068	18,087	18,106	
Lake	53,548	53,638	53,712	53,771	53,852	53,934	54,015	54,094	54,174	54,252	54,329	
Madison	12,612	12,649	12,655	12,673	12,693	12,713	12,734	12,756	12,778	12,801	12,824	
Marion	99,691	99,833	99,910	100,003	100,170	100,340	100,508	100,677	100,844	101,010	101,178	
St. Joseph	35,596	35,651	35,694	35,733	35,792	35,852	35,911	35,968	36,023	36,078	36,133	

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:											
	5/8	5/9	5/10	5/11	5/13				5/15				5/17			
Decatur	2,847	2,848	2,852	2,854	2,861	(572)	[137]	{69}	2,869	(574)	[138]	{69}	2,877	(575)	[138]	{69}
Hamilton	35,536	35,569	35,597	35,629	35,701	(7,140)	[1,714]	{857}	35,771	(7,154)	[1,717]	{859}	35,836	(7,167)	[1,720]	{860}
Hendricks	17,199	17,209	17,227	17,244	17,287	(3,457)	[830]	{415}	17,330	(3,466)	[832]	{416}	17,373	(3,475)	[834]	{417}
Johnson	17,923	17,933	17,952	17,970	18,010	(3,602)	[864]	{432}	18,049	(3,610)	[866]	{433}	18,087	(3,617)	[868]	{434}
Lake	53,548	53,638	53,712	53,771	53,934	(10,787)	[2,589]	{1,294}	54,094	(10,819)	[2,596]	{1,298}	54,252	(10,850)	[2,604]	{1,302}
Madison	12,612	12,649	12,655	12,673	12,713	(2,543)	[610]	{305}	12,756	(2,551)	[612]	{306}	12,801	(2,560)	[614]	{307}
Marion	99,691	99,833	99,910	100,003	100,340	(20,068)	[4,816]	{2,408}	100,677	(20,135)	[4,832]	{2,416}	101,010	(20,202)	[4,848]	{2,424}
St. Joseph	35,596	35,651	35,694	35,733	35,852	(7,170)	[1,721]	{860}	35,968	(7,194)	[1,726]	{863}	36,078	(7,216)	[1,732]	{866}

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.