

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

Date: 9/27/21

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 9/27/21 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.

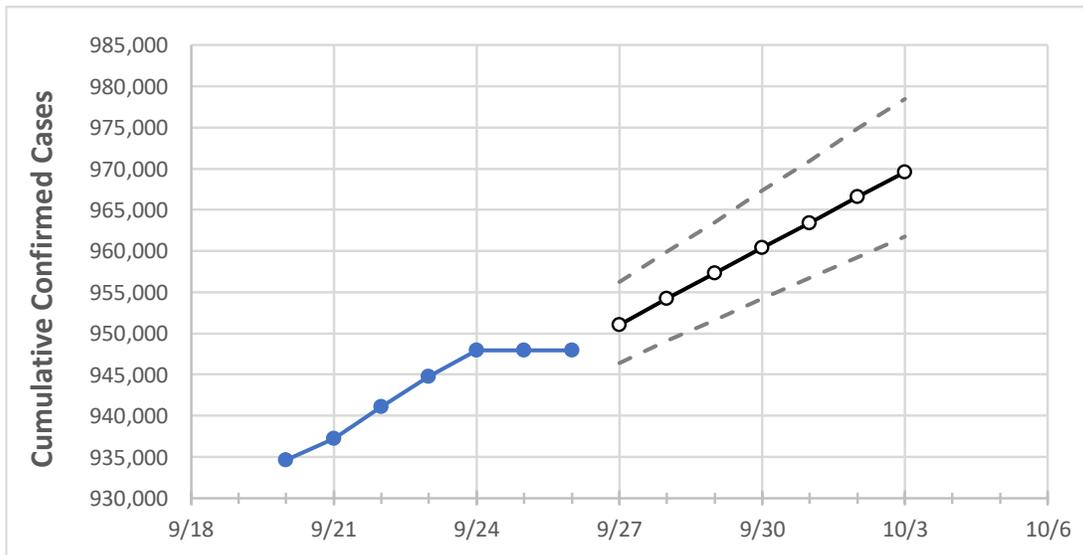
IEM's Modeling Lead

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Indiana	944,708	947,918	947,918	947,918	951,064	954,230	957,326	960,386	963,411	966,618	969,581

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Decatur	3,859	3,887	3,887	3,887	3,900	3,911	3,923	3,934	3,945	3,956	3,967
Hamilton	43,980	44,082	44,082	44,082	44,196	44,307	44,417	44,526	44,633	44,740	44,849
Hendricks	22,354	22,410	22,410	22,410	22,486	22,556	22,634	22,703	22,778	22,849	22,918
Johnson	23,685	23,727	23,727	23,727	23,789	23,848	23,906	23,967	24,022	24,079	24,135
Lake	63,432	63,572	63,572	63,572	63,705	63,835	63,964	64,093	64,222	64,350	64,479
Madison	17,439	17,492	17,492	17,492	17,556	17,619	17,680	17,741	17,803	17,863	17,924
Marion	128,705	129,118	129,118	129,118	129,541	129,963	130,387	130,794	131,214	131,639	132,051
St. Joseph	42,010	42,122	42,122	42,122	42,225	42,327	42,428	42,532	42,634	42,737	42,838

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:								
	9/23	9/24	9/25	9/26	9/28			9/30			10/2		
Decatur	3,859	3,887	3,887	3,887	3,911 (782) [188] {94}			3,934 (787) [189] {94}			3,956 (791) [190] {95}		
Hamilton	43,980	44,082	44,082	44,082	44,307 (8,861) [2,127] {1,063}			44,526 (8,905) [2,137] {1,069}			44,740 (8,948) [2,148] {1,074}		
Hendricks	22,354	22,410	22,410	22,410	22,556 (4,511) [1,083] {541}			22,703 (4,541) [1,090] {545}			22,849 (4,570) [1,097] {548}		
Johnson	23,685	23,727	23,727	23,727	23,848 (4,770) [1,145] {572}			23,967 (4,793) [1,150] {575}			24,079 (4,816) [1,156] {578}		
Lake	63,432	63,572	63,572	63,572	63,835 (12,767) [3,064] {1,532}			64,093 (12,819) [3,076] {1,538}			64,350 (12,870) [3,089] {1,544}		
Madison	17,439	17,492	17,492	17,492	17,619 (3,524) [846] {423}			17,741 (3,548) [852] {426}			17,863 (3,573) [857] {429}		
Marion	128,705	129,118	129,118	129,118	129,963 (25,993) [6,238] {3,119}			130,794 (26,159) [6,278] {3,139}			131,639 (26,328) [6,319] {3,159}		
St. Joseph	42,010	42,122	42,122	42,122	42,327 (8,465) [2,032] {1,016}			42,532 (8,506) [2,042] {1,021}			42,737 (8,547) [2,051] {1,026}		

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.