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

Date: 3/22/22

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 3/22/22 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.

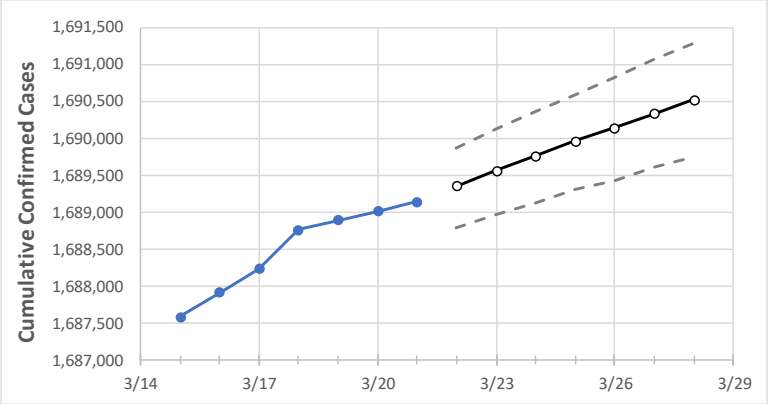
IEM's Modeling Lead

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Indiana	1,688,770	1,688,894	1,689,018	1,689,142	1,689,354	1,689,566	1,689,768	1,689,963	1,690,146	1,690,338	1,690,520

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Decatur	6,988	6,988	6,988	6,988	6,989	6,989	6,990	6,990	6,991	6,992	6,992
Hamilton	81,560	81,575	81,589	81,604	81,618	81,630	81,643	81,654	81,667	81,679	81,690
Hendricks	40,659	40,660	40,660	40,661	40,664	40,666	40,669	40,671	40,673	40,675	40,677
Johnson	42,197	42,199	42,201	42,203	42,206	42,210	42,213	42,216	42,219	42,222	42,224
Lake	105,805	105,818	105,831	105,844	105,860	105,877	105,893	105,909	105,924	105,940	105,956
Madison	32,587	32,589	32,591	32,593	32,597	32,601	32,604	32,608	32,611	32,615	32,618
Marion	224,563	224,560	224,556	224,553	224,612	224,664	224,718	224,775	224,822	224,879	224,933
St. Joseph	70,401	70,406	70,410	70,415	70,423	70,431	70,439	70,447	70,455	70,462	70,470

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:		
	3/18	3/19	3/20	3/21	3/23	3/25	3/27
Decatur	6,988	6,988	6,988	6,988	6,989 (1,398) [335] {168}	6,990 (1,398) [336] {168}	6,992 (1,398) [336] {168}
Hamilton	81,560	81,575	81,589	81,604	81,630 (16,326) [3,918] {1,959}	81,654 (16,331) [3,919] {1,960}	81,679 (16,336) [3,921] {1,960}
Hendricks	40,659	40,660	40,660	40,661	40,666 (8,133) [1,952] {976}	40,671 (8,134) [1,952] {976}	40,675 (8,135) [1,952] {976}
Johnson	42,197	42,199	42,201	42,203	42,210 (8,442) [2,026] {1,013}	42,216 (8,443) [2,026] {1,013}	42,222 (8,444) [2,027] {1,013}
Lake	105,805	105,818	105,831	105,844	105,877 (21,175) [5,082] {2,541}	105,909 (21,182) [5,084] {2,542}	105,940 (21,188) [5,085] {2,543}
Madison	32,587	32,589	32,591	32,593	32,601 (6,520) [1,565] {782}	32,608 (6,522) [1,565] {783}	32,615 (6,523) [1,565] {783}
Marion	224,563	224,560	224,556	224,553	224,664 (44,933) [10,784] {5,392}	224,775 (44,955) [10,789] {5,395}	224,879 (44,976) [10,794] {5,397}
St. Joseph	70,401	70,406	70,410	70,415	70,431 (14,086) [3,381] {1,690}	70,447 (14,089) [3,381] {1,691}	70,462 (14,092) [3,382] {1,691}

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.