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

Date: 5/21/21

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 5/21 /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.

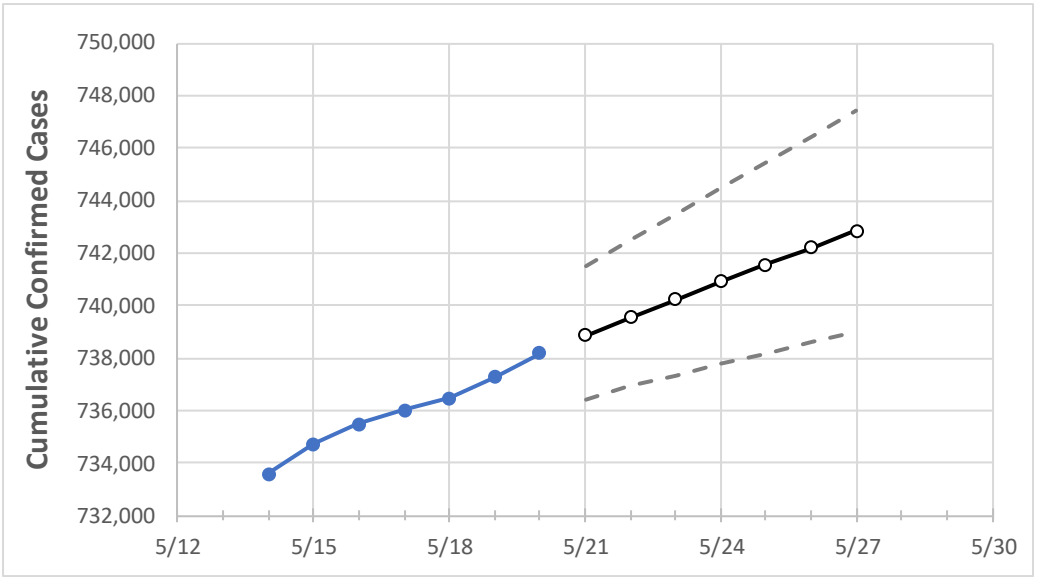
IEM's Modeling Lead

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Indiana	735,999	736,480	737,282	738,173	738,875	739,561	740,237	740,912	741,563	742,212	742,832

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Decatur	2,861	2,862	2,864	2,866	2,868	2,869	2,871	2,872	2,874	2,875	2,877
Hamilton	35,829	35,859	35,891	35,924	35,952	35,979	36,006	36,032	36,057	36,081	36,106
Hendricks	17,317	17,325	17,343	17,361	17,373	17,385	17,396	17,408	17,419	17,430	17,441
Johnson	18,067	18,076	18,097	18,114	18,129	18,143	18,158	18,172	18,186	18,199	18,213
Lake	54,249	54,304	54,367	54,449	54,518	54,587	54,655	54,722	54,788	54,852	54,915
Madison	12,762	12,768	12,779	12,795	12,809	12,822	12,836	12,850	12,863	12,876	12,889
Marion	100,715	100,785	100,894	101,040	101,146	101,244	101,341	101,437	101,529	101,622	101,712
St. Joseph	36,335	36,352	36,408	36,445	36,484	36,521	36,557	36,592	36,625	36,657	36,689

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:		
	5/17	5/18	5/19	5/20	5/22	5/24	5/26
Decatur	2,861	2,862	2,864	2,866	2,869 (574) [138] {69}	2,872 (574) [138] {69}	2,875 (575) [138] {69}
Hamilton	35,829	35,859	35,891	35,924	35,979 (7,196) [1,727] {864}	36,032 (7,206) [1,730] {865}	36,081 (7,216) [1,732] {866}
Hendricks	17,317	17,325	17,343	17,361	17,385 (3,477) [834] {417}	17,408 (3,482) [836] {418}	17,430 (3,486) [837] {418}
Johnson	18,067	18,076	18,097	18,114	18,143 (3,629) [871] {435}	18,172 (3,634) [872] {436}	18,199 (3,640) [874] {437}
Lake	54,249	54,304	54,367	54,449	54,587 (10,917) [2,620] {1,310}	54,722 (10,944) [2,627] {1,313}	54,852 (10,970) [2,633] {1,316}
Madison	12,762	12,768	12,779	12,795	12,822 (2,564) [615] {308}	12,850 (2,570) [617] {308}	12,876 (2,575) [618] {309}
Marion	100,715	100,785	100,894	101,040	101,244 (20,249) [4,860] {2,430}	101,437 (20,287) [4,869] {2,434}	101,622 (20,324) [4,878] {2,439}
St. Joseph	36,335	36,352	36,408	36,445	36,521 (7,304) [1,753] {877}	36,592 (7,318) [1,756] {878}	36,657 (7,331) [1,760] {880}

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.