IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/28/21

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 5/28/21 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
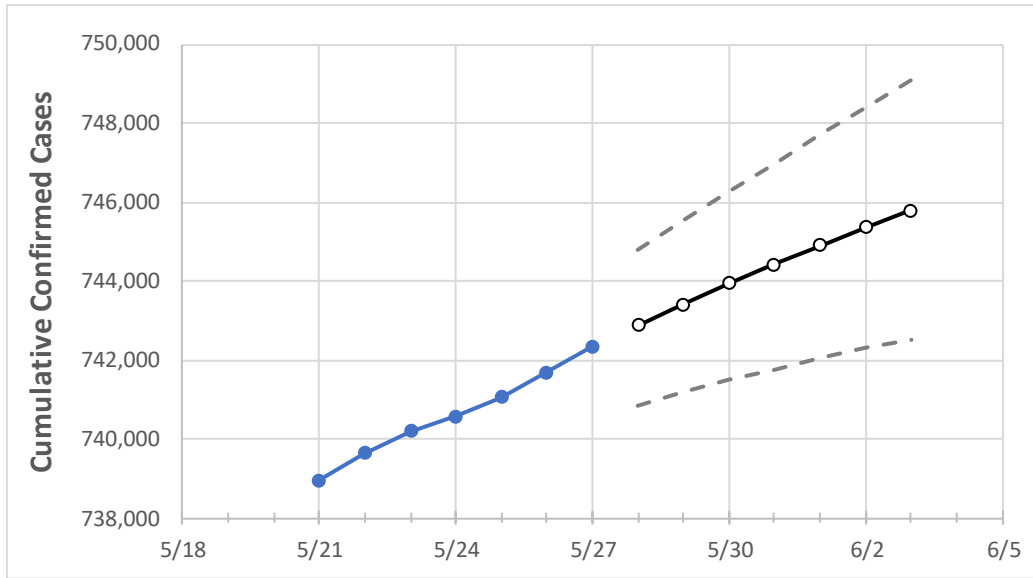
	Actual Confirmed Cases On:				Projected Cases For:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
Indiana	740,564	741,053	741,697	742,353	742,886	743,408	743,931	744,421	744,901	745,364	745,800

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:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
Decatur	2,873	2,876	2,878	2,881	2,883	2,884	2,886	2,887	2,889	2,891	2,892
Hamilton	36,046	36,070	36,078	36,102	36,125	36,147	36,169	36,190	36,210	36,230	36,250
Hendricks	17,416	17,428	17,441	17,456	17,468	17,481	17,493	17,505	17,517	17,528	17,540
Johnson	18,155	18,164	18,183	18,194	18,204	18,213	18,223	18,232	18,240	18,249	18,258
Lake	54,696	54,747	54,789	54,864	54,920	54,974	55,026	55,078	55,128	55,177	55,223
Madison	12,831	12,844	12,860	12,871	12,879	12,887	12,895	12,903	12,910	12,916	12,923
Marion	101,425	101,513	101,599	101,688	101,772	101,851	101,931	102,006	102,079	102,154	102,226
St. Joseph	36,581	36,610	36,651	36,681	36,707	36,734	36,759	36,783	36,805	36,828	36,849

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:		
	5/24	5/25	5/26	5/27	5/29	5/31	6/2
Decatur	2,873	2,876	2,878	2,881	2,884 (577) [138] {69}	2,887 (577) [139] {69}	2,891 (578) [139] {69}
Hamilton	36,046	36,070	36,078	36,102	36,147 (7,229) [1,735] {868}	36,190 (7,238) [1,737] {869}	36,230 (7,246) [1,739] {870}
Hendricks	17,416	17,428	17,441	17,456	17,481 (3,496) [839] {420}	17,505 (3,501) [840] {420}	17,528 (3,506) [841] {421}
Johnson	18,155	18,164	18,183	18,194	18,213 (3,643) [874] {437}	18,232 (3,646) [875] {438}	18,249 (3,650) [876] {438}
Lake	54,696	54,747	54,789	54,864	54,974 (10,995) [2,639] {1,319}	55,078 (11,016) [2,644] {1,322}	55,177 (11,035) [2,648] {1,324}
Madison	12,831	12,844	12,860	12,871	12,887 (2,577) [619] {309}	12,903 (2,581) [619] {310}	12,916 (2,583) [620] {310}
Marion	101,425	101,513	101,599	101,688	101,851 (20,370) [4,889] {2,444}	102,006 (20,401) [4,896] {2,448}	102,154 (20,431) [4,903] {2,452}
St. Joseph	36,581	36,610	36,651	36,681	36,734 (7,347) [1,763] {882}	36,783 (7,357) [1,766] {883}	36,828 (7,366) [1,768] {884}

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.