IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/25/21

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 <u>not</u> 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 5/25/21 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
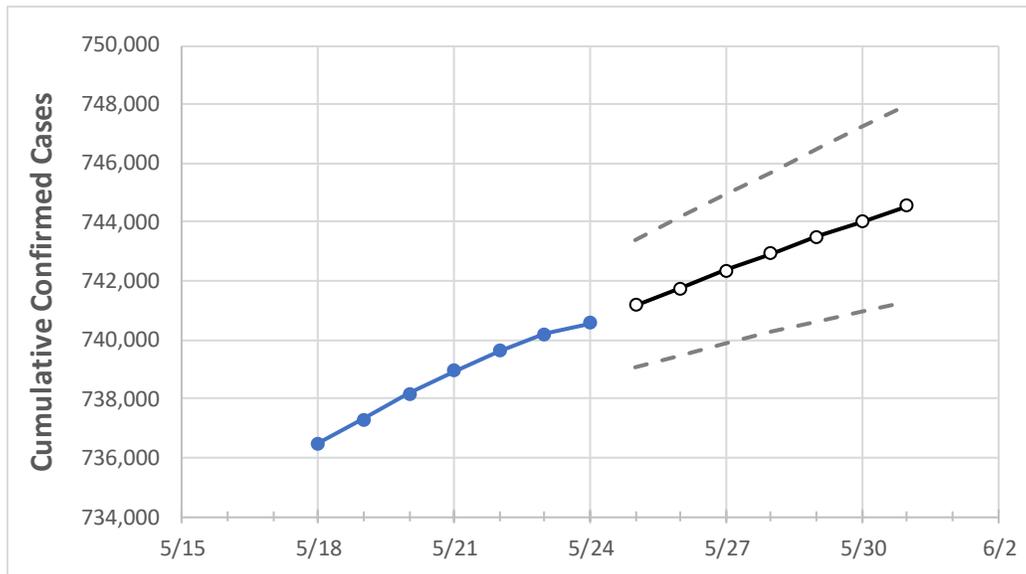
	Actual Confirmed Cases On:				Projected Cases For:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Indiana	738,961	739,626	740,189	740,564	741,175	741,765	742,363	742,937	743,507	744,021	744,554

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Decatur	2,870	2,871	2,872	2,873	2,874	2,876	2,877	2,879	2,880	2,881	2,883
Hamilton	35,955	35,989	36,020	36,046	36,072	36,098	36,123	36,147	36,171	36,195	36,218
Hendricks	17,380	17,390	17,403	17,416	17,428	17,440	17,451	17,463	17,474	17,485	17,496
Johnson	18,121	18,138	18,148	18,155	18,167	18,179	18,190	18,201	18,212	18,222	18,232
Lake	54,541	54,619	54,666	54,696	54,758	54,818	54,878	54,937	54,995	55,051	55,104
Madison	12,802	12,813	12,822	12,831	12,842	12,853	12,863	12,874	12,884	12,894	12,904
Marion	101,152	101,264	101,363	101,425	101,516	101,606	101,691	101,774	101,855	101,935	102,012
St. Joseph	36,478	36,523	36,556	36,581	36,613	36,645	36,675	36,704	36,731	36,758	36,783

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:		
	5/21	5/22	5/23	5/24	5/26	5/28	5/30
Decatur	2,870	2,871	2,872	2,873	2,876 (575) [138] {69}	2,879 (576) [138] {69}	2,881 (576) [138] {69}
Hamilton	35,955	35,989	36,020	36,046	36,098 (7,220) [1,733] {866}	36,147 (7,229) [1,735] {868}	36,195 (7,239) [1,737] {869}
Hendricks	17,380	17,390	17,403	17,416	17,440 (3,488) [837] {419}	17,463 (3,493) [838] {419}	17,485 (3,497) [839] {420}
Johnson	18,121	18,138	18,148	18,155	18,179 (3,636) [873] {436}	18,201 (3,640) [874] {437}	18,222 (3,644) [875] {437}
Lake	54,541	54,619	54,666	54,696	54,818 (10,964) [2,631] {1,316}	54,937 (10,987) [2,637] {1,318}	55,051 (11,010) [2,642] {1,321}
Madison	12,802	12,813	12,822	12,831	12,853 (2,571) [617] {308}	12,874 (2,575) [618] {309}	12,894 (2,579) [619] {309}
Marion	101,152	101,264	101,363	101,425	101,606 (20,321) [4,877] {2,439}	101,774 (20,355) [4,885] {2,443}	101,935 (20,387) [4,893] {2,446}
St. Joseph	36,478	36,523	36,556	36,581	36,645 (7,329) [1,759] {879}	36,704 (7,341) [1,762] {881}	36,758 (7,352) [1,764] {882}

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.