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

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 5/5/21 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
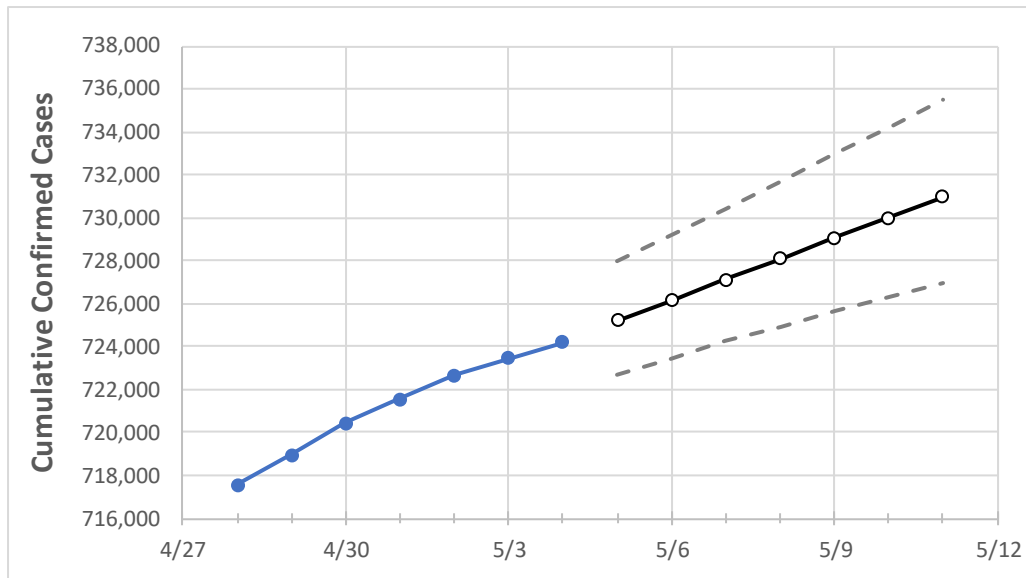
	Actual Confirmed Cases On:				Projected Cases For:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
Indiana	721,577	722,646	723,443	724,214	725,201	726,163	727,140	728,116	729,066	730,024	730,979

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:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
Decatur	2,823	2,825	2,826	2,829	2,832	2,835	2,838	2,842	2,845	2,849	2,853
Hamilton	35,229	35,288	35,322	35,354	35,405	35,455	35,506	35,555	35,605	35,654	35,704
Hendricks	17,054	17,072	17,086	17,098	17,115	17,133	17,150	17,167	17,185	17,203	17,220
Johnson	17,787	17,808	17,821	17,832	17,850	17,867	17,885	17,902	17,919	17,936	17,952
Lake	52,935	53,031	53,113	53,172	53,268	53,365	53,462	53,557	53,652	53,746	53,841
Madison	12,485	12,501	12,510	12,519	12,530	12,540	12,550	12,560	12,570	12,579	12,589
Marion	98,455	98,637	98,753	98,907	99,061	99,218	99,371	99,525	99,678	99,836	99,992
St. Joseph	35,086	35,148	35,214	35,270	35,336	35,402	35,470	35,536	35,600	35,665	35,725

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:		
	5/1	5/2	5/3	5/4	5/6	5/8	5/10
Decatur	2,823	2,825	2,826	2,829	2,835 (567) [136] {68}	2,842 (568) [136] {68}	2,849 (570) [137] {68}
Hamilton	35,229	35,288	35,322	35,354	35,455 (7,091) [1,702] {851}	35,555 (7,111) [1,707] {853}	35,654 (7,131) [1,711] {856}
Hendricks	17,054	17,072	17,086	17,098	17,133 (3,427) [822] {411}	17,167 (3,433) [824] {412}	17,203 (3,441) [826] {413}
Johnson	17,787	17,808	17,821	17,832	17,867 (3,573) [858] {429}	17,902 (3,580) [859] {430}	17,936 (3,587) [861] {430}
Lake	52,935	53,031	53,113	53,172	53,365 (10,673) [2,562] {1,281}	53,557 (10,711) [2,571] {1,285}	53,746 (10,749) [2,580] {1,290}
Madison	12,485	12,501	12,510	12,519	12,540 (2,508) [602] {301}	12,560 (2,512) [603] {301}	12,579 (2,516) [604] {302}
Marion	98,455	98,637	98,753	98,907	99,218 (19,844) [4,762] {2,381}	99,525 (19,905) [4,777] {2,389}	99,836 (19,967) [4,792] {2,396}
St. Joseph	35,086	35,148	35,214	35,270	35,402 (7,080) [1,699] {850}	35,536 (7,107) [1,706] {853}	35,665 (7,133) [1,712] {856}

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.