IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/3/21

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 6/3/21 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
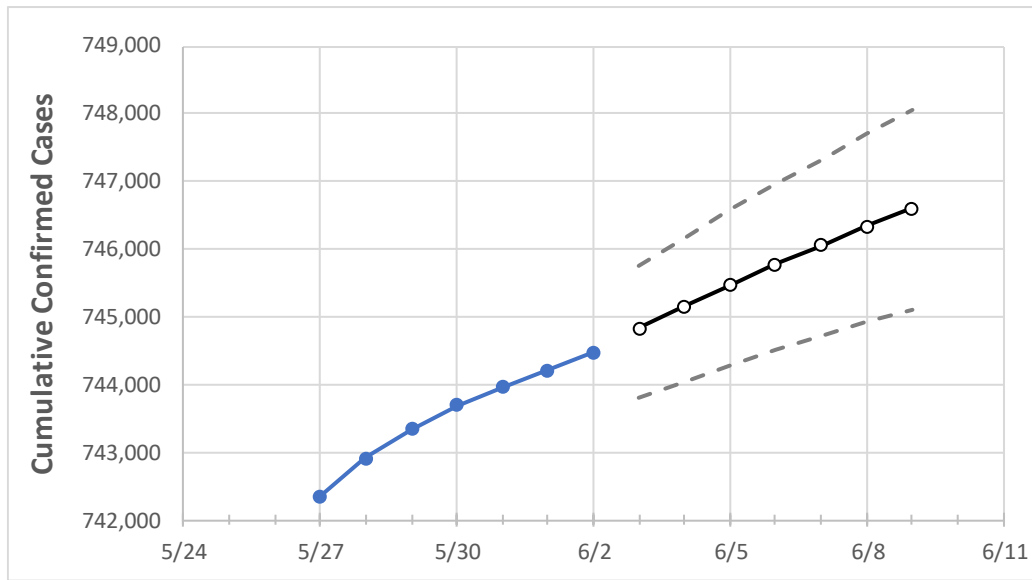
	Actual Confirmed Cases On:				Projected Cases For:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
Indiana	743,696	743,955	744,213	744,474	744,826	745,156	745,472	745,772	746,058	746,334	746,599

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:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
Decatur	2,887	2,888	2,888	2,889	2,890	2,892	2,893	2,895	2,896	2,898	2,899
Hamilton	36,168	36,182	36,195	36,204	36,219	36,234	36,248	36,262	36,275	36,287	36,299
Hendricks	17,481	17,487	17,493	17,498	17,506	17,514	17,522	17,529	17,537	17,544	17,551
Johnson	18,225	18,232	18,238	18,245	18,253	18,261	18,269	18,276	18,284	18,290	18,297
Lake	54,965	54,993	55,020	55,032	55,068	55,102	55,136	55,167	55,199	55,228	55,256
Madison	12,901	12,909	12,916	12,920	12,928	12,936	12,943	12,950	12,957	12,964	12,971
Marion	101,896	101,934	101,971	102,018	102,075	102,129	102,181	102,233	102,280	102,325	102,370
St. Joseph	36,746	36,761	36,776	36,789	36,807	36,824	36,841	36,856	36,871	36,886	36,900

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:		
	5/30	5/31	6/1	6/2	6/4	6/6	6/8
Decatur	2,887	2,888	2,888	2,889	2,892 (578) [139] {69}	2,895 (579) [139] {69}	2,898 (580) [139] {70}
Hamilton	36,168	36,182	36,195	36,204	36,234 (7,247) [1,739] {870}	36,262 (7,252) [1,741] {870}	36,287 (7,257) [1,742] {871}
Hendricks	17,481	17,487	17,493	17,498	17,514 (3,503) [841] {420}	17,529 (3,506) [841] {421}	17,544 (3,509) [842] {421}
Johnson	18,225	18,232	18,238	18,245	18,261 (3,652) [877] {438}	18,276 (3,655) [877] {439}	18,290 (3,658) [878] {439}
Lake	54,965	54,993	55,020	55,032	55,102 (11,020) [2,645] {1,322}	55,167 (11,033) [2,648] {1,324}	55,228 (11,046) [2,651] {1,325}
Madison	12,901	12,909	12,916	12,920	12,936 (2,587) [621] {310}	12,950 (2,590) [622] {311}	12,964 (2,593) [622] {311}
Marion	101,896	101,934	101,971	102,018	102,129 (20,426) [4,902] {2,451}	102,233 (20,447) [4,907] {2,454}	102,325 (20,465) [4,912] {2,456}
St. Joseph	36,746	36,761	36,776	36,789	36,824 (7,365) [1,768] {884}	36,856 (7,371) [1,769] {885}	36,886 (7,377) [1,771] {885}

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.