IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/3/21

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 11/3/21 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
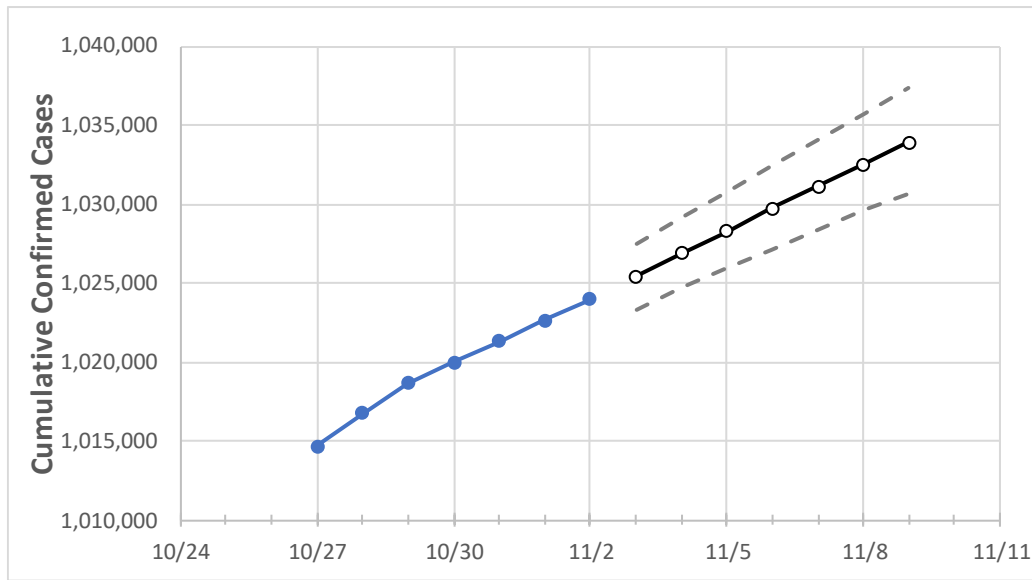
	Actual Confirmed Cases On:				Projected Cases For:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Indiana	1,019,962	1,021,285	1,022,609	1,023,980	1,025,435	1,026,878	1,028,273	1,029,699	1,031,096	1,032,492	1,033,898

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Decatur	4,201	4,205	4,208	4,211	4,215	4,219	4,223	4,227	4,231	4,235	4,239
Hamilton	46,821	46,872	46,922	46,974	47,028	47,081	47,134	47,187	47,239	47,291	47,342
Hendricks	24,130	24,161	24,192	24,203	24,230	24,255	24,281	24,307	24,331	24,357	24,381
Johnson	25,370	25,405	25,440	25,468	25,500	25,534	25,565	25,598	25,629	25,661	25,692
Lake	67,113	67,201	67,288	67,385	67,478	67,571	67,662	67,754	67,847	67,940	68,032
Madison	19,005	19,037	19,069	19,097	19,127	19,157	19,186	19,216	19,246	19,275	19,304
Marion	136,708	136,839	136,969	137,138	137,280	137,422	137,563	137,699	137,835	137,977	138,110
St. Joseph	44,972	45,049	45,125	45,206	45,282	45,359	45,437	45,513	45,592	45,671	45,747

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:		
	10/30	10/31	11/1	11/2	11/4	11/6	11/8
Decatur	4,201	4,205	4,208	4,211	4,219 (844) [203] {101}	4,227 (845) [203] {101}	4,235 (847) [203] {102}
Hamilton	46,821	46,872	46,922	46,974	47,081 (9,416) [2,260] {1,130}	47,187 (9,437) [2,265] {1,132}	47,291 (9,458) [2,270] {1,135}
Hendricks	24,130	24,161	24,192	24,203	24,255 (4,851) [1,164] {582}	24,307 (4,861) [1,167] {583}	24,357 (4,871) [1,169] {585}
Johnson	25,370	25,405	25,440	25,468	25,534 (5,107) [1,226] {613}	25,598 (5,120) [1,229] {614}	25,661 (5,132) [1,232] {616}
Lake	67,113	67,201	67,288	67,385	67,571 (13,514) [3,243] {1,622}	67,754 (13,551) [3,252] {1,626}	67,940 (13,588) [3,261] {1,631}
Madison	19,005	19,037	19,069	19,097	19,157 (3,831) [920] {460}	19,216 (3,843) [922] {461}	19,275 (3,855) [925] {463}
Marion	136,708	136,839	136,969	137,138	137,422 (27,484) [6,596] {3,298}	137,699 (27,540) [6,610] {3,305}	137,977 (27,595) [6,623] {3,311}
St. Joseph	44,972	45,049	45,125	45,206	45,359 (9,072) [2,177] {1,089}	45,513 (9,103) [2,185] {1,092}	45,671 (9,134) [2,192] {1,096}

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.