IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/30/21

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 8/30/21 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
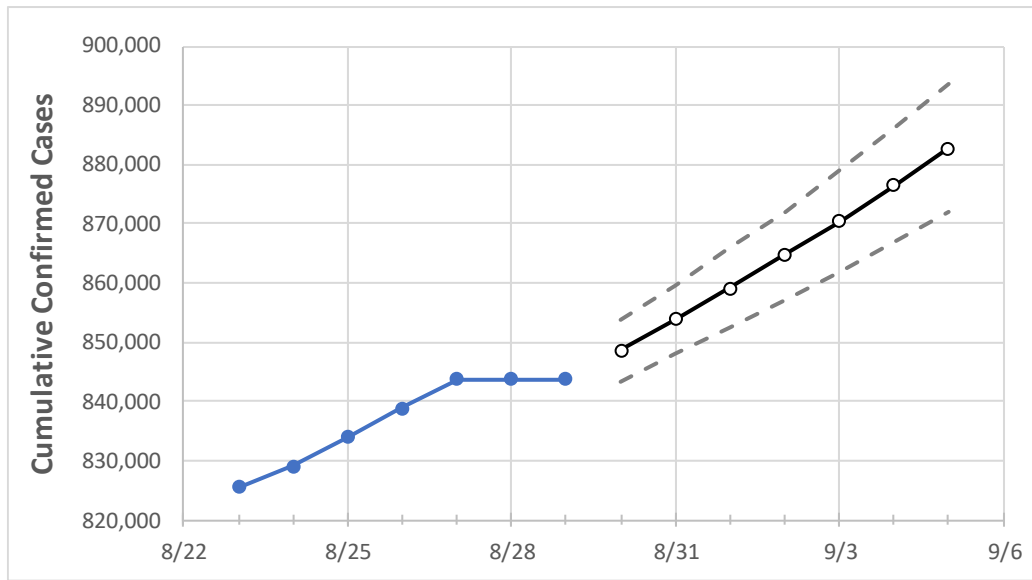
	Actual Confirmed Cases On:				Projected Cases For:						
	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5
Indiana	838,869	843,700	843,700	843,700	848,651	853,851	859,151	864,768	870,497	876,455	882,684

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:						
	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5
Decatur	3,304	3,327	3,327	3,327	3,361	3,397	3,434	3,473	3,515	3,559	3,605
Hamilton	40,096	40,241	40,241	40,241	40,420	40,608	40,795	40,995	41,197	41,413	41,629
Hendricks	19,733	19,854	19,854	19,854	19,958	20,070	20,181	20,297	20,417	20,542	20,669
Johnson	20,990	21,138	21,138	21,138	21,305	21,482	21,666	21,858	22,059	22,270	22,489
Lake	59,280	59,465	59,465	59,465	59,619	59,780	59,941	60,113	60,290	60,473	60,663
Madison	15,210	15,332	15,332	15,332	15,445	15,564	15,687	15,812	15,943	16,086	16,226
Marion	114,976	115,693	115,693	115,693	116,356	117,026	117,727	118,475	119,238	120,034	120,857
St. Joseph	38,897	39,019	39,019	39,019	39,142	39,270	39,404	39,543	39,688	39,845	40,004

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:		
	8/26	8/27	8/28	8/29	8/31	9/2	9/4
Decatur	3,304	3,327	3,327	3,327	3,397 (679) [163] {82}	3,473 (695) [167] {83}	3,559 (712) [171] {85}
Hamilton	40,096	40,241	40,241	40,241	40,608 (8,122) [1,949] {975}	40,995 (8,199) [1,968] {984}	41,413 (8,283) [1,988] {994}
Hendricks	19,733	19,854	19,854	19,854	20,070 (4,014) [963] {482}	20,297 (4,059) [974] {487}	20,542 (4,108) [986] {493}
Johnson	20,990	21,138	21,138	21,138	21,482 (4,296) [1,031] {516}	21,858 (4,372) [1,049] {525}	22,270 (4,454) [1,069] {534}
Lake	59,280	59,465	59,465	59,465	59,780 (11,956) [2,869] {1,435}	60,113 (12,023) [2,885] {1,443}	60,473 (12,095) [2,903] {1,451}
Madison	15,210	15,332	15,332	15,332	15,564 (3,113) [747] {374}	15,812 (3,162) [759] {379}	16,086 (3,217) [772] {386}
Marion	114,976	115,693	115,693	115,693	117,026 (23,405) [5,617] {2,809}	118,475 (23,695) [5,687] {2,843}	120,034 (24,007) [5,762] {2,881}
St. Joseph	38,897	39,019	39,019	39,019	39,270 (7,854) [1,885] {942}	39,543 (7,909) [1,898] {949}	39,845 (7,969) [1,913] {956}

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.