IEM's AI Modeling: Short-term COVID-19 Projections

Date: 9/1/21

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 not 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 9/1/21 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.

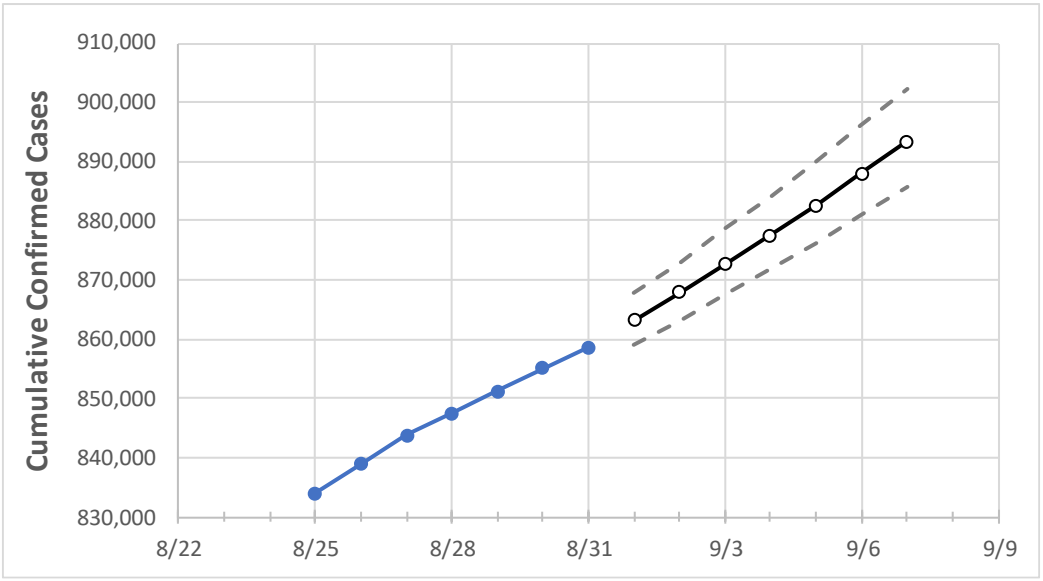
IEM's Modeling Lead

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Indiana	847,477	851,254	855,031	858,566	863,163	867,867	872,585	877,572	882,671	888,007	893,388

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Decatur	3,359	3,390	3,422	3,425	3,458	3,492	3,526	3,562	3,601	3,641	3,682
Hamilton	40,392	40,544	40,695	40,780	40,948	41,122	41,298	41,483	41,670	41,865	42,067
Hendricks	19,959	20,063	20,168	20,248	20,357	20,468	20,582	20,700	20,822	20,951	21,074
Johnson	21,248	21,358	21,468	21,559	21,710	21,861	22,016	22,182	22,347	22,523	22,705
Lake	59,578	59,691	59,804	60,005	60,162	60,325	60,490	60,662	60,840	61,024	61,212
Madison	15,410	15,487	15,565	15,685	15,797	15,910	16,029	16,150	16,276	16,408	16,538
Marion	116,223	116,753	117,283	117,681	118,266	118,879	119,496	120,135	120,799	121,481	122,178
St. Joseph	39,107	39,194	39,282	39,412	39,529	39,654	39,783	39,914	40,055	40,198	40,346

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:		
	8/28	8/29	8/30	8/31	9/2	9/4	9/6
Decatur	3,359	3,390	3,422	3,425	3,492 (698) [168] {84}	3,562 (712) [171] {85}	3,641 (728) [175] {87}
Hamilton	40,392	40,544	40,695	40,780	41,122 (8,224) [1,974] {987}	41,483 (8,297) [1,991] {996}	41,865 (8,373) [2,009] {1,005}
Hendricks	19,959	20,063	20,168	20,248	20,468 (4,094) [982] {491}	20,700 (4,140) [994] {497}	20,951 (4,190) [1,006] {503}
Johnson	21,248	21,358	21,468	21,559	21,861 (4,372) [1,049] {525}	22,182 (4,436) [1,065] {532}	22,523 (4,505) [1,081] {541}
Lake	59,578	59,691	59,804	60,005	60,325 (12,065) [2,896] {1,448}	60,662 (12,132) [2,912] {1,456}	61,024 (12,205) [2,929] {1,465}
Madison	15,410	15,487	15,565	15,685	15,910 (3,182) [764] {382}	16,150 (3,230) [775] {388}	16,408 (3,282) [788] {394}
Marion	116,223	116,753	117,283	117,681	118,879 (23,776) [5,706] {2,853}	120,135 (24,027) [5,766] {2,883}	121,481 (24,296) [5,831] {2,916}
St. Joseph	39,107	39,194	39,282	39,412	39,654 (7,931) [1,903] {952}	39,914 (7,983) [1,916] {958}	40,198 (8,040) [1,930] {965}

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.