IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/3/21

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 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 9/3/21 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
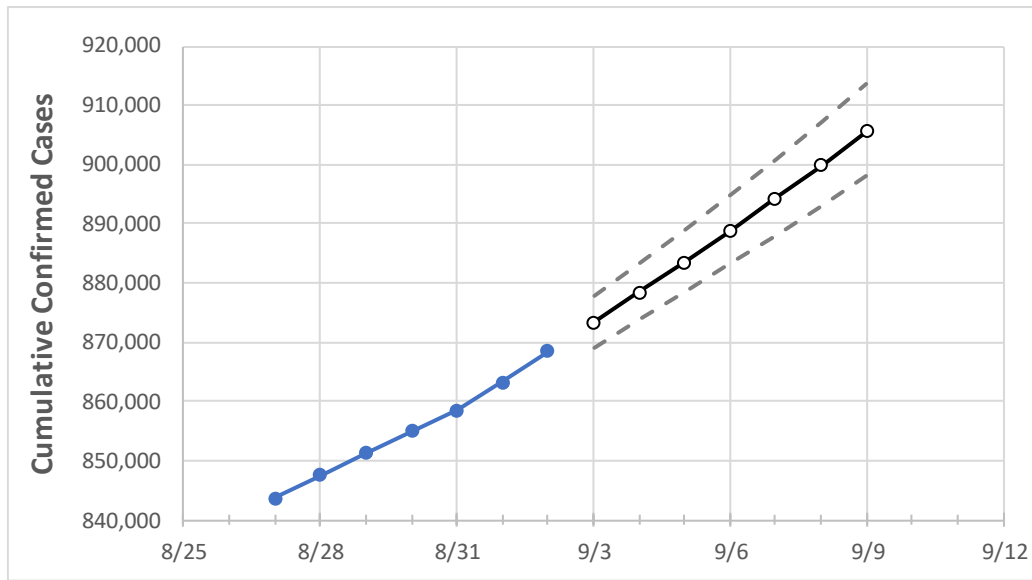
	Actual Confirmed Cases On:				Projected Cases For:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Indiana	855,031	858,566	863,299	868,451	873,344	878,371	883,443	888,794	894,292	899,881	905,640

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:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Decatur	3,422	3,425	3,458	3,489	3,523	3,557	3,593	3,630	3,669	3,710	3,751
Hamilton	40,695	40,780	40,946	41,117	41,292	41,466	41,646	41,827	42,019	42,213	42,411
Hendricks	20,168	20,248	20,327	20,438	20,547	20,657	20,772	20,890	21,011	21,136	21,263
Johnson	21,468	21,559	21,704	21,854	22,010	22,171	22,334	22,506	22,678	22,862	23,047
Lake	59,804	60,005	60,173	60,355	60,525	60,703	60,884	61,074	61,270	61,472	61,683
Madison	15,565	15,685	15,789	15,893	16,008	16,126	16,246	16,370	16,497	16,634	16,768
Marion	117,283	117,681	118,200	118,793	119,406	120,030	120,663	121,319	121,982	122,678	123,379
St. Joseph	39,282	39,412	39,568	39,738	39,882	40,032	40,188	40,353	40,521	40,700	40,884

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:		
	8/30	8/31	9/1	9/2	9/4	9/6	9/8
Decatur	3,422	3,425	3,458	3,489	3,557 (711) [171] {85}	3,630 (726) [174] {87}	3,710 (742) [178] {89}
Hamilton	40,695	40,780	40,946	41,117	41,466 (8,293) [1,990] {995}	41,827 (8,365) [2,008] {1,004}	42,213 (8,443) [2,026] {1,013}
Hendricks	20,168	20,248	20,327	20,438	20,657 (4,131) [992] {496}	20,890 (4,178) [1,003] {501}	21,136 (4,227) [1,015] {507}
Johnson	21,468	21,559	21,704	21,854	22,171 (4,434) [1,064] {532}	22,506 (4,501) [1,080] {540}	22,862 (4,572) [1,097] {549}
Lake	59,804	60,005	60,173	60,355	60,703 (12,141) [2,914] {1,457}	61,074 (12,215) [2,932] {1,466}	61,472 (12,294) [2,951] {1,475}
Madison	15,565	15,685	15,789	15,893	16,126 (3,225) [774] {387}	16,370 (3,274) [786] {393}	16,634 (3,327) [798] {399}
Marion	117,283	117,681	118,200	118,793	120,030 (24,006) [5,761] {2,881}	121,319 (24,264) [5,823] {2,912}	122,678 (24,536) [5,889] {2,944}
St. Joseph	39,282	39,412	39,568	39,738	40,032 (8,006) [1,922] {961}	40,353 (8,071) [1,937] {968}	40,700 (8,140) [1,954] {977}

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.