IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/24/21

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 9/24/21 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
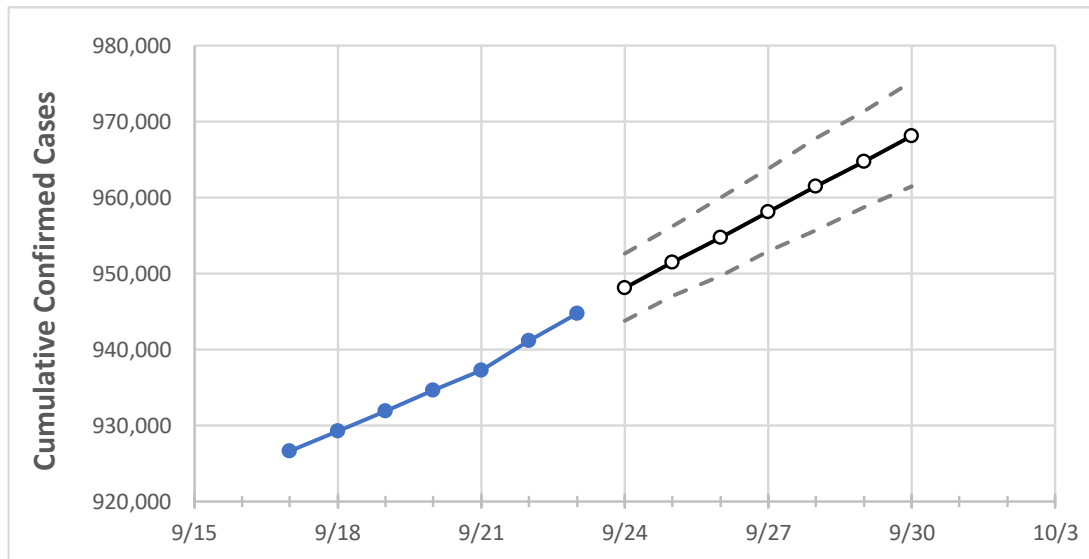
	Actual Confirmed Cases On:				Projected Cases For:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
Indiana	934,586	937,221	941,120	944,708	948,122	951,438	954,760	958,134	961,495	964,740	968,079

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:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
Decatur	3,834	3,839	3,852	3,859	3,875	3,891	3,905	3,920	3,935	3,950	3,963
Hamilton	43,603	43,720	43,827	43,980	44,106	44,233	44,356	44,483	44,605	44,729	44,857
Hendricks	22,102	22,143	22,250	22,354	22,441	22,527	22,613	22,700	22,788	22,873	22,959
Johnson	23,466	23,524	23,609	23,685	23,758	23,828	23,897	23,967	24,033	24,101	24,168
Lake	62,992	63,162	63,304	63,432	63,577	63,718	63,858	63,999	64,139	64,283	64,425
Madison	17,213	17,280	17,366	17,439	17,506	17,573	17,640	17,705	17,773	17,837	17,902
Marion	127,287	127,611	128,251	128,705	129,172	129,626	130,084	130,534	130,989	131,449	131,907
St. Joseph	41,729	41,805	41,906	42,010	42,118	42,223	42,328	42,433	42,538	42,647	42,752

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:		
	9/20	9/21	9/22	9/23	9/25	9/27	9/29
Decatur	3,834	3,839	3,852	3,859	3,891 (778) [187] {93}	3,920 (784) [188] {94}	3,950 (790) [190] {95}
Hamilton	43,603	43,720	43,827	43,980	44,233 (8,847) [2,123] {1,062}	44,483 (8,897) [2,135] {1,068}	44,729 (8,946) [2,147] {1,073}
Hendricks	22,102	22,143	22,250	22,354	22,527 (4,505) [1,081] {541}	22,700 (4,540) [1,090] {545}	22,873 (4,575) [1,098] {549}
Johnson	23,466	23,524	23,609	23,685	23,828 (4,766) [1,144] {572}	23,967 (4,793) [1,150] {575}	24,101 (4,820) [1,157] {578}
Lake	62,992	63,162	63,304	63,432	63,718 (12,744) [3,058] {1,529}	63,999 (12,800) [3,072] {1,536}	64,283 (12,857) [3,086] {1,543}
Madison	17,213	17,280	17,366	17,439	17,573 (3,515) [844] {422}	17,705 (3,541) [850] {425}	17,837 (3,567) [856] {428}
Marion	127,287	127,611	128,251	128,705	129,626 (25,925) [6,222] {3,111}	130,534 (26,107) [6,266] {3,133}	131,449 (26,290) [6,310] {3,155}
St. Joseph	41,729	41,805	41,906	42,010	42,223 (8,445) [2,027] {1,013}	42,433 (8,487) [2,037] {1,018}	42,647 (8,529) [2,047] {1,024}

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.