IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/11/21

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 8/11/21 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
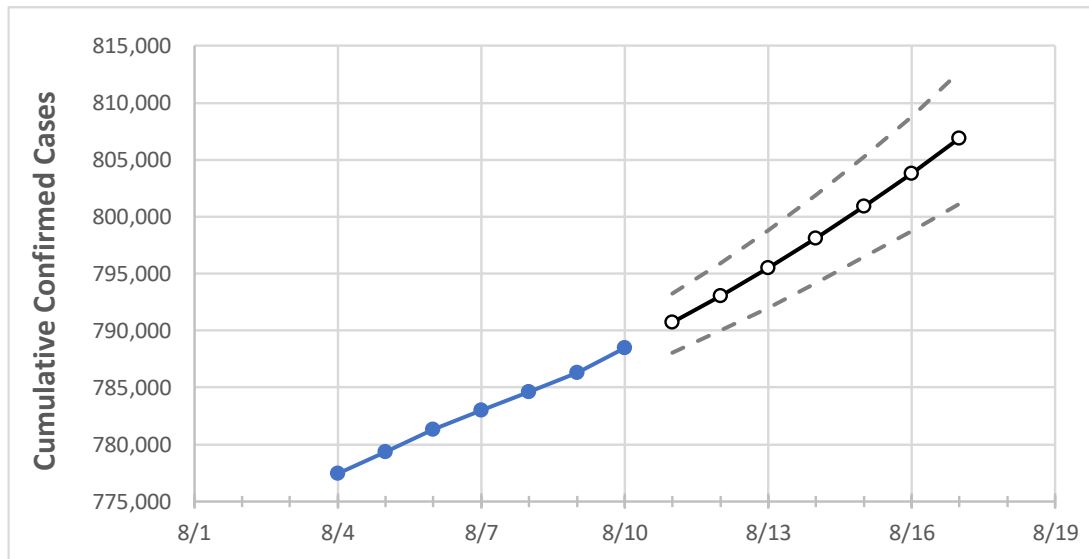
	Actual Confirmed Cases On:				Projected Cases For:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Indiana	782,975	784,623	786,272	788,468	790,685	793,024	795,497	798,126	800,878	803,775	806,866

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:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Decatur	2,969	2,976	2,982	3,002	3,014	3,027	3,042	3,059	3,078	3,099	3,124
Hamilton	37,930	37,997	38,065	38,138	38,221	38,307	38,398	38,493	38,589	38,693	38,801
Hendricks	18,438	18,478	18,518	18,578	18,632	18,690	18,751	18,815	18,883	18,957	19,034
Johnson	19,231	19,279	19,328	19,374	19,434	19,497	19,565	19,637	19,713	19,795	19,882
Lake	57,493	57,538	57,583	57,694	57,771	57,850	57,933	58,021	58,118	58,219	58,326
Madison	13,902	13,954	14,005	14,056	14,117	14,181	14,251	14,326	14,405	14,492	14,583
Marion	107,664	107,928	108,193	108,478	108,797	109,132	109,490	109,865	110,263	110,686	111,132
St. Joseph	37,678	37,714	37,750	37,782	37,829	37,879	37,931	37,988	38,046	38,109	38,175

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:		
	8/7	8/8	8/9	8/10	8/12	8/14	8/16
Decatur	2,969	2,976	2,982	3,002	3,027 (605) [145] {73}	3,059 (612) [147] {73}	3,099 (620) [149] {74}
Hamilton	37,930	37,997	38,065	38,138	38,307 (7,661) [1,839] {919}	38,493 (7,699) [1,848] {924}	38,693 (7,739) [1,857] {929}
Hendricks	18,438	18,478	18,518	18,578	18,690 (3,738) [897] {449}	18,815 (3,763) [903] {452}	18,957 (3,791) [910] {455}
Johnson	19,231	19,279	19,328	19,374	19,497 (3,899) [936] {468}	19,637 (3,927) [943] {471}	19,795 (3,959) [950] {475}
Lake	57,493	57,538	57,583	57,694	57,850 (11,570) [2,777] {1,388}	58,021 (11,604) [2,785] {1,393}	58,219 (11,644) [2,795] {1,397}
Madison	13,902	13,954	14,005	14,056	14,181 (2,836) [681] {340}	14,326 (2,865) [688] {344}	14,492 (2,898) [696] {348}
Marion	107,664	107,928	108,193	108,478	109,132 (21,826) [5,238] {2,619}	109,865 (21,973) [5,274] {2,637}	110,686 (22,137) [5,313] {2,656}
St. Joseph	37,678	37,714	37,750	37,782	37,879 (7,576) [1,818] {909}	37,988 (7,598) [1,823] {912}	38,109 (7,622) [1,829] {915}

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.