IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/29/21

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 6/29/21 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
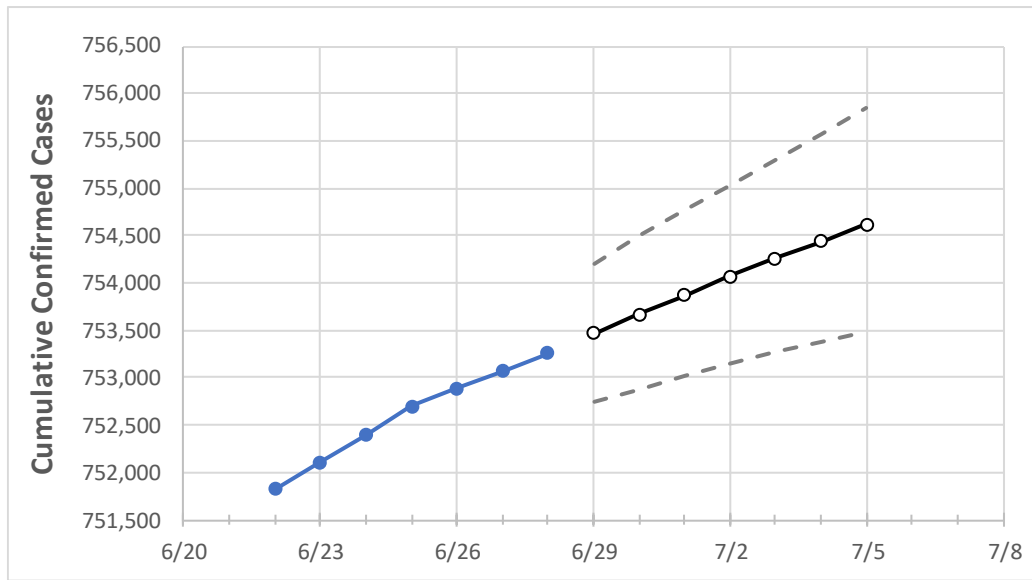
	Actual Confirmed Cases On:				Projected Cases For:						
	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5
Indiana	752,699	752,886	753,073	753,260	753,465	753,669	753,866	754,066	754,260	754,441	754,615

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:						
	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5
Decatur	2,900	2,900	2,900	2,900	2,901	2,902	2,903	2,904	2,906	2,907	2,908
Hamilton	36,650	36,660	36,670	36,680	36,688	36,697	36,705	36,713	36,721	36,728	36,735
Hendricks	17,713	17,720	17,726	17,733	17,738	17,744	17,749	17,755	17,760	17,765	17,770
Johnson	18,500	18,505	18,509	18,514	18,520	18,526	18,531	18,537	18,542	18,548	18,553
Lake	55,920	55,938	55,955	55,973	56,000	56,026	56,053	56,079	56,102	56,126	56,149
Madison	13,190	13,193	13,197	13,200	13,205	13,210	13,215	13,220	13,225	13,230	13,234
Marion	103,422	103,446	103,469	103,493	103,513	103,532	103,550	103,567	103,583	103,599	103,614
St. Joseph	37,020	37,025	37,029	37,034	37,038	37,041	37,044	37,047	37,050	37,053	37,055

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:		
	6/25	6/26	6/27	6/28	6/30	7/2	7/4
Decatur	2,900	2,900	2,900	2,900	2,902 (580) [139] {70}	2,904 (581) [139] {70}	2,907 (581) [140] {70}
Hamilton	36,650	36,660	36,670	36,680	36,697 (7,339) [1,761] {881}	36,713 (7,343) [1,762] {881}	36,728 (7,346) [1,763] {881}
Hendricks	17,713	17,720	17,726	17,733	17,744 (3,549) [852] {426}	17,755 (3,551) [852] {426}	17,765 (3,553) [853] {426}
Johnson	18,500	18,505	18,509	18,514	18,526 (3,705) [889] {445}	18,537 (3,707) [890] {445}	18,548 (3,710) [890] {445}
Lake	55,920	55,938	55,955	55,973	56,026 (11,205) [2,689] {1,345}	56,079 (11,216) [2,692] {1,346}	56,126 (11,225) [2,694] {1,347}
Madison	13,190	13,193	13,197	13,200	13,210 (2,642) [634] {317}	13,220 (2,644) [635] {317}	13,230 (2,646) [635] {318}
Marion	103,422	103,446	103,469	103,493	103,532 (20,706) [4,970] {2,485}	103,567 (20,713) [4,971] {2,486}	103,599 (20,720) [4,973] {2,486}
St. Joseph	37,020	37,025	37,029	37,034	37,041 (7,408) [1,778] {889}	37,047 (7,409) [1,778] {889}	37,053 (7,411) [1,779] {889}

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.