IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/23/21

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 6/23/21 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
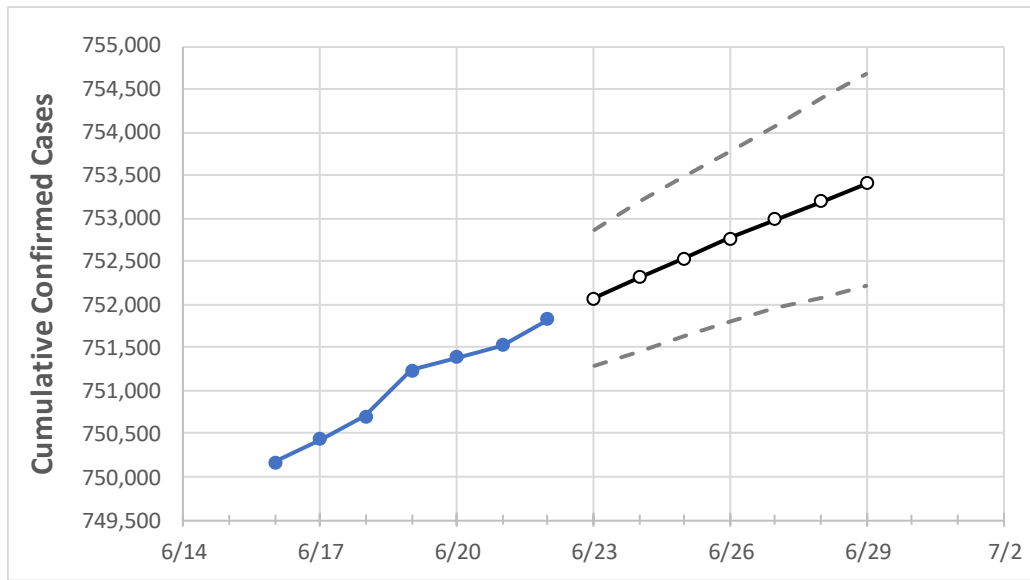
	Actual Confirmed Cases On:				Projected Cases For:						
	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29
Indiana	751,242	751,384	751,526	751,826	752,073	752,311	752,541	752,767	752,989	753,204	753,408

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:						
	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29
Decatur	2,898	2,898	2,898	2,898	2,901	2,904	2,908	2,911	2,915	2,919	2,923
Hamilton	36,588	36,596	36,604	36,612	36,622	36,632	36,642	36,651	36,661	36,669	36,678
Hendricks	17,682	17,686	17,689	17,692	17,696	17,700	17,704	17,708	17,712	17,715	17,719
Johnson	18,471	18,474	18,477	18,481	18,489	18,498	18,507	18,516	18,524	18,533	18,542
Lake	55,691	55,703	55,715	55,786	55,823	55,861	55,900	55,936	55,974	56,011	56,050
Madison	13,149	13,154	13,158	13,166	13,170	13,174	13,178	13,182	13,186	13,190	13,193
Marion	103,293	103,311	103,328	103,358	103,389	103,418	103,446	103,473	103,500	103,525	103,548
St. Joseph	36,990	36,994	36,998	37,001	37,006	37,011	37,016	37,020	37,024	37,028	37,032

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:		
	6/19	6/20	6/21	6/22	6/24	6/26	6/28
Decatur	2,898	2,898	2,898	2,898	2,904 (581) [139] {70}	2,911 (582) [140] {70}	2,919 (584) [140] {70}
Hamilton	36,588	36,596	36,604	36,612	36,632 (7,326) [1,758] {879}	36,651 (7,330) [1,759] {880}	36,669 (7,334) [1,760] {880}
Hendricks	17,682	17,686	17,689	17,692	17,700 (3,540) [850] {425}	17,708 (3,542) [850] {425}	17,715 (3,543) [850] {425}
Johnson	18,471	18,474	18,477	18,481	18,498 (3,700) [888] {444}	18,516 (3,703) [889] {444}	18,533 (3,707) [890] {445}
Lake	55,691	55,703	55,715	55,786	55,861 (11,172) [2,681] {1,341}	55,936 (11,187) [2,685] {1,342}	56,011 (11,202) [2,689] {1,344}
Madison	13,149	13,154	13,158	13,166	13,174 (2,635) [632] {316}	13,182 (2,636) [633] {316}	13,190 (2,638) [633] {317}
Marion	103,293	103,311	103,328	103,358	103,418 (20,684) [4,964] {2,482}	103,473 (20,695) [4,967] {2,483}	103,525 (20,705) [4,969] {2,485}
St. Joseph	36,990	36,994	36,998	37,001	37,011 (7,402) [1,777] {888}	37,020 (7,404) [1,777] {888}	37,028 (7,406) [1,777] {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.