IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/27/21

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 4/27/21 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
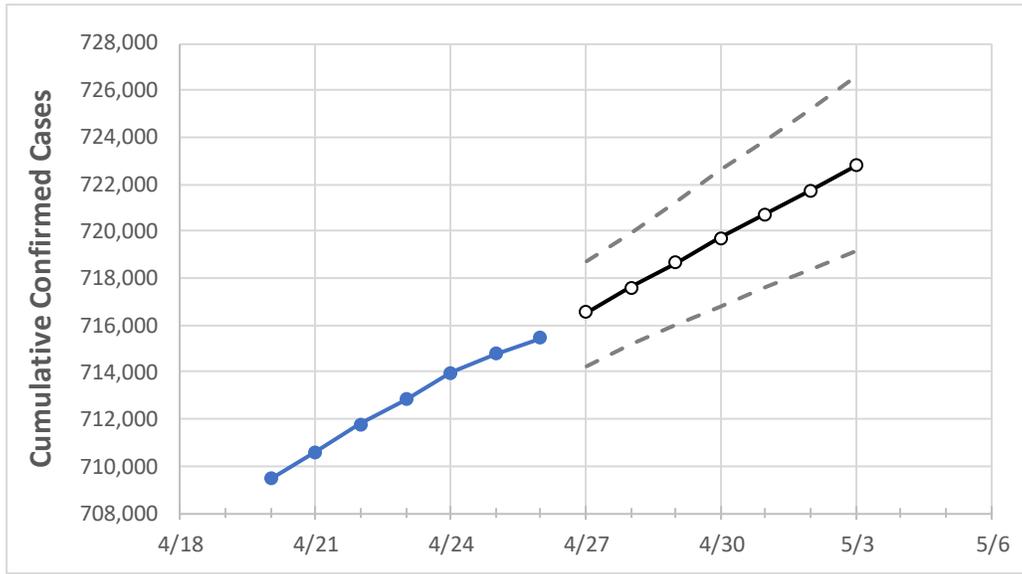
	Actual Confirmed Cases On:				Projected Cases For:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Indiana	712,858	713,959	714,786	715,468	716,556	717,617	718,669	719,711	720,734	721,761	722,798

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Decatur	2,799	2,805	2,810	2,811	2,813	2,816	2,818	2,820	2,823	2,825	2,828
Hamilton	34,774	34,832	34,891	34,928	34,986	35,045	35,104	35,163	35,222	35,280	35,340
Hendricks	16,889	16,907	16,913	16,921	16,935	16,949	16,962	16,975	16,988	17,000	17,012
Johnson	17,617	17,635	17,648	17,659	17,677	17,694	17,711	17,728	17,745	17,761	17,777
Lake	52,121	52,217	52,313	52,386	52,497	52,609	52,722	52,837	52,951	53,067	53,186
Madison	12,389	12,394	12,401	12,407	12,417	12,427	12,436	12,446	12,455	12,465	12,474
Marion	97,182	97,339	97,442	97,552	97,695	97,841	97,987	98,130	98,272	98,414	98,557
St. Joseph	34,485	34,576	34,642	34,701	34,781	34,865	34,947	35,029	35,109	35,190	35,268

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:		
	4/23	4/24	4/25	4/26	4/28	4/30	5/2
Decatur	2,799	2,805	2,810	2,811	2,816 (563) [135] {68}	2,820 (564) [135] {68}	2,825 (565) [136] {68}
Hamilton	34,774	34,832	34,891	34,928	35,045 (7,009) [1,682] {841}	35,163 (7,033) [1,688] {844}	35,280 (7,056) [1,693] {847}
Hendricks	16,889	16,907	16,913	16,921	16,949 (3,390) [814] {407}	16,975 (3,395) [815] {407}	17,000 (3,400) [816] {408}
Johnson	17,617	17,635	17,648	17,659	17,694 (3,539) [849] {425}	17,728 (3,546) [851] {425}	17,761 (3,552) [853] {426}
Lake	52,121	52,217	52,313	52,386	52,609 (10,522) [2,525] {1,263}	52,837 (10,567) [2,536] {1,268}	53,067 (10,613) [2,547] {1,274}
Madison	12,389	12,394	12,401	12,407	12,427 (2,485) [596] {298}	12,446 (2,489) [597] {299}	12,465 (2,493) [598] {299}
Marion	97,182	97,339	97,442	97,552	97,841 (19,568) [4,696] {2,348}	98,130 (19,626) [4,710] {2,355}	98,414 (19,683) [4,724] {2,362}
St. Joseph	34,485	34,576	34,642	34,701	34,865 (6,973) [1,674] {837}	35,029 (7,006) [1,681] {841}	35,190 (7,038) [1,689] {845}

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.