IEM's AI Modeling: Short-term COVID-19 Projections

Date: 3/2/22

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 not 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 3/2/22 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.

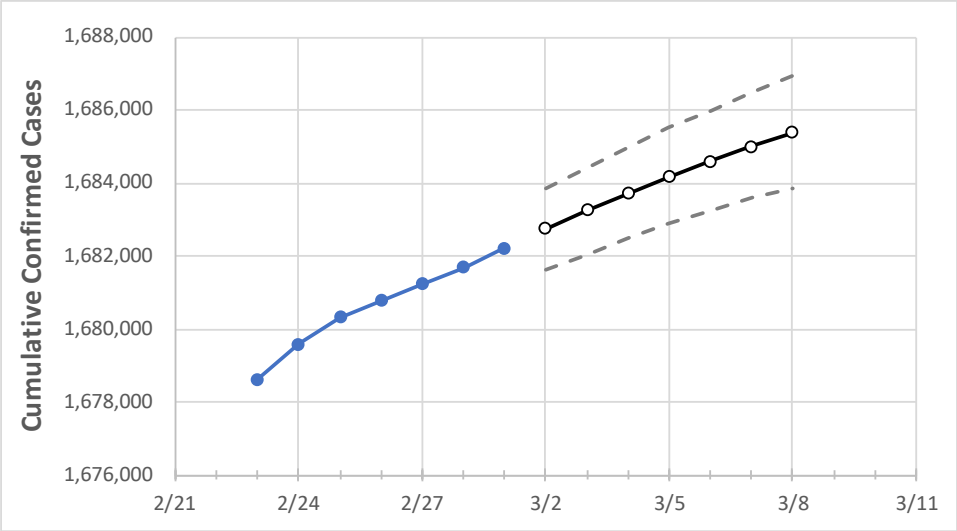
IEM's Modeling Lead

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Indiana	1,680,782	1,681,234	1,681,685	1,682,222	1,682,758	1,683,254	1,683,718	1,684,177	1,684,601	1,684,994	1,685,374

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Decatur	6,965	6,965	6,966	6,969	6,971	6,973	6,975	6,976	6,978	6,980	6,981
Hamilton	81,166	81,177	81,189	81,214	81,249	81,284	81,317	81,346	81,380	81,410	81,437
Hendricks	40,514	40,528	40,541	40,553	40,567	40,580	40,592	40,604	40,615	40,626	40,636
Johnson	42,064	42,071	42,079	42,088	42,098	42,107	42,115	42,124	42,131	42,139	42,146
Lake	105,328	105,355	105,382	105,410	105,434	105,457	105,479	105,501	105,521	105,541	105,559
Madison	32,448	32,457	32,465	32,479	32,491	32,502	32,513	32,523	32,533	32,543	32,551
Marion	223,150	223,193	223,235	223,277	223,328	223,376	223,420	223,463	223,502	223,541	223,578
St. Joseph	70,122	70,142	70,162	70,173	70,191	70,208	70,224	70,239	70,253	70,268	70,281

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:		
	2/26	2/27	2/28	3/1	3/3	3/5	3/7
Decatur	6,965	6,965	6,966	6,969	6,973 (1,395) [335] {167}	6,976 (1,395) [335] {167}	6,980 (1,396) [335] {168}
Hamilton	81,166	81,177	81,189	81,214	81,284 (16,257) [3,902] {1,951}	81,346 (16,269) [3,905] {1,952}	81,410 (16,282) [3,908] {1,954}
Hendricks	40,514	40,528	40,541	40,553	40,580 (8,116) [1,948] {974}	40,604 (8,121) [1,949] {974}	40,626 (8,125) [1,950] {975}
Johnson	42,064	42,071	42,079	42,088	42,107 (8,421) [2,021] {1,011}	42,124 (8,425) [2,022] {1,011}	42,139 (8,428) [2,023] {1,011}
Lake	105,328	105,355	105,382	105,410	105,457 (21,091) [5,062] {2,531}	105,501 (21,100) [5,064] {2,532}	105,541 (21,108) [5,066] {2,533}
Madison	32,448	32,457	32,465	32,479	32,502 (6,500) [1,560] {780}	32,523 (6,505) [1,561] {781}	32,543 (6,509) [1,562] {781}
Marion	223,150	223,193	223,235	223,277	223,376 (44,675) [10,722] {5,361}	223,463 (44,693) [10,726] {5,363}	223,541 (44,708) [10,730] {5,365}
St. Joseph	70,122	70,142	70,162	70,173	70,208 (14,042) [3,370] {1,685}	70,239 (14,048) [3,371] {1,686}	70,268 (14,054) [3,373] {1,686}

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.