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

Date: 3/26/21

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 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 3/26/21 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.

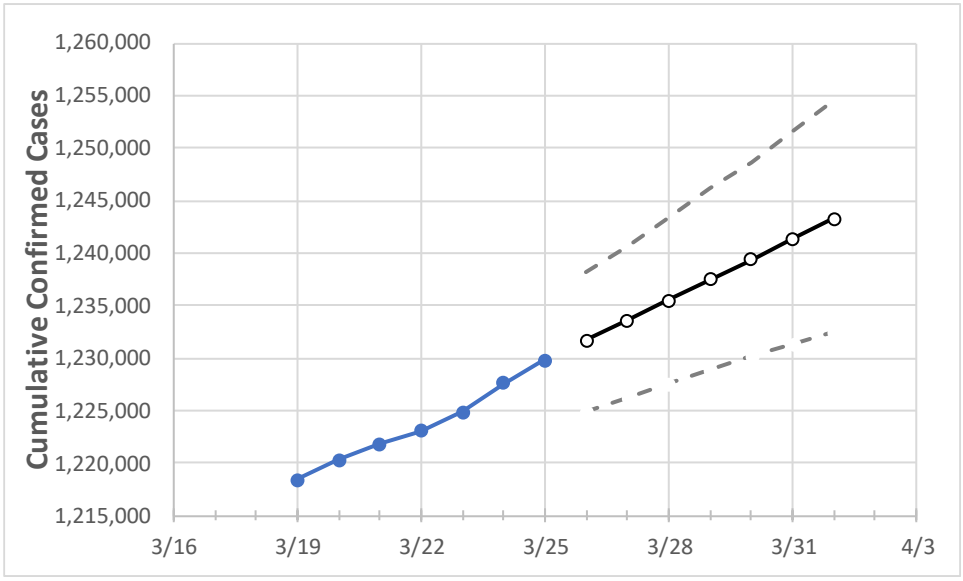
IEM's Modeling Lead

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.

Illinois State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Illinois	1,222,992	1,224,804	1,227,613	1,229,806	1,231,659	1,233,611	1,235,495	1,237,446	1,239,384	1,241,348	1,243,293

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.

Illinois Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Cook	488,793	489,484	490,661	491,512	492,316	493,120	493,926	494,744	495,586	496,431	497,284
DuPage	80,121	80,285	80,560	80,728	80,907	81,089	81,269	81,456	81,644	81,835	82,028
Kane	52,067	52,123	52,233	52,339	52,395	52,452	52,509	52,565	52,622	52,680	52,738
Lake	61,407	61,486	61,584	61,652	61,725	61,798	61,871	61,942	62,012	62,083	62,154
McHenry	25,187	25,225	25,307	25,353	25,389	25,424	25,460	25,496	25,533	25,569	25,605
Will	67,374	67,435	67,604	67,707	67,799	67,891	67,984	68,078	68,170	68,262	68,352

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.*

Illinois Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	3/22	3/23	3/24	3/25	3/27	3/29	3/31
Cook	488,793	489,484	490,661	491,512	493,120 (98,624) [23,670] {11,835}	494,744 (98,949) [23,748] {11,874}	496,431 (99,286) [23,829] {11,914}
DuPage	80,121	80,285	80,560	80,728	81,089 (16,218) [3,892] {1,946}	81,456 (16,291) [3,910] {1,955}	81,835 (16,367) [3,928] {1,964}
Kane	52,067	52,123	52,233	52,339	52,452 (10,490) [2,518] {1,259}	52,565 (10,513) [2,523] {1,262}	52,680 (10,536) [2,529] {1,264}
Lake	61,407	61,486	61,584	61,652	61,798 (12,360) [2,966] {1,483}	61,942 (12,388) [2,973] {1,487}	62,083 (12,417) [2,980] {1,490}
McHenry	25,187	25,225	25,307	25,353	25,424 (5,085) [1,220] {610}	25,496 (5,099) [1,224] {612}	25,569 (5,114) [1,227] {614}
Will	67,374	67,435	67,604	67,707	67,891 (13,578) [3,259] {1,629}	68,078 (13,616) [3,268] {1,634}	68,262 (13,652) [3,277] {1,638}

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.