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

Date: 1/29/21

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 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 1/29/21 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.

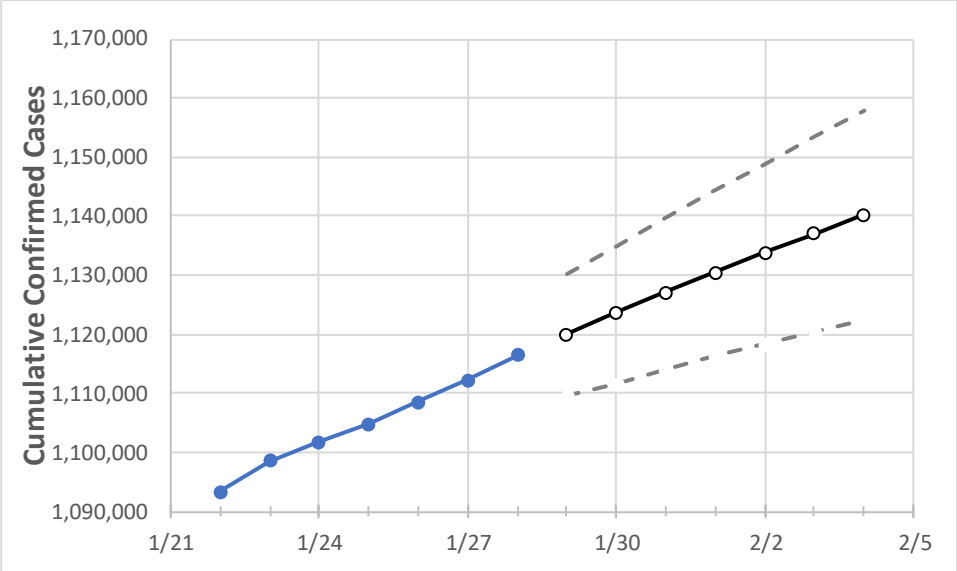
IEM's Modeling Lead

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.

Illinois State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4
Illinois	1,104,763	1,108,430	1,112,181	1,116,372	1,120,063	1,123,621	1,127,087	1,130,486	1,133,830	1,137,089	1,140,250

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:						
	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4
Cook	446,035	447,295	448,546	450,116	451,388	452,666	453,893	455,087	456,218	457,363	458,462
DuPage	71,070	71,323	71,529	71,819	72,048	72,275	72,486	72,707	72,912	73,108	73,301
Kane	47,289	47,475	47,657	47,840	48,013	48,182	48,349	48,516	48,675	48,830	48,984
Lake	54,851	55,096	55,275	55,452	55,649	55,836	56,018	56,202	56,379	56,551	56,721
McHenry	22,290	22,372	22,435	22,533	22,611	22,686	22,760	22,831	22,901	22,969	23,035
Will	59,914	60,159	60,378	60,614	60,821	61,026	61,222	61,412	61,599	61,784	61,959

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:		
	1/25	1/26	1/27	1/28	1/30	2/1	2/3
Cook	446,035	447,295	448,546	450,116	452,666 (90,533) [21,728] {10,864}	455,087 (91,017) [21,844] {10,922}	457,363 (91,473) [21,953] {10,977}
DuPage	71,070	71,323	71,529	71,819	72,275 (14,455) [3,469] {1,735}	72,707 (14,541) [3,490] {1,745}	73,108 (14,622) [3,509] {1,755}
Kane	47,289	47,475	47,657	47,840	48,182 (9,636) [2,313] {1,156}	48,516 (9,703) [2,329] {1,164}	48,830 (9,766) [2,344] {1,172}
Lake	54,851	55,096	55,275	55,452	55,836 (11,167) [2,680] {1,340}	56,202 (11,240) [2,698] {1,349}	56,551 (11,310) [2,714] {1,357}
McHenry	22,290	22,372	22,435	22,533	22,686 (4,537) [1,089] {544}	22,831 (4,566) [1,096] {548}	22,969 (4,594) [1,103] {551}
Will	59,914	60,159	60,378	60,614	61,026 (12,205) [2,929] {1,465}	61,412 (12,282) [2,948] {1,474}	61,784 (12,357) [2,966] {1,483}

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.