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

Date: 11/12/20

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 11/12/20 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.

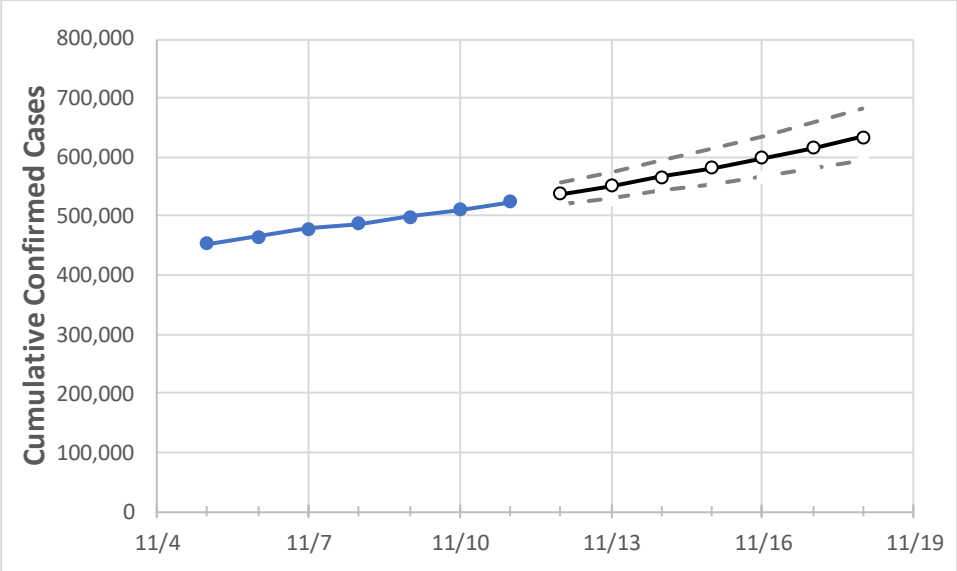
IEM's Modeling Lead

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:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Illinois	487,987	498,560	511,183	523,840	537,236	551,379	566,306	582,058	598,674	616,199	634,678

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 20%, and are often within 10%, of actual confirmed cases.

Illinois Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Cook	218,662	223,110	227,425	231,462	236,612	242,046	247,779	253,826	260,204	266,928	274,016
DuPage	30,244	30,977	31,830	32,487	33,368	34,299	35,283	36,321	37,417	38,573	39,793
Kane	22,192	22,579	23,179	23,798	24,445	25,130	25,855	26,622	27,433	28,290	29,195
Lake	26,144	26,541	27,189	27,920	28,621	29,372	30,178	31,041	31,965	32,955	34,016
McHenry	9,204	9,521	9,786	10,111	10,486	10,887	11,318	11,779	12,273	12,801	13,367
Will	24,580	25,132	25,892	26,627	27,437	28,300	29,220	30,199	31,243	32,354	33,537

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:											
	11/8	11/9	11/10	11/11	11/13				11/15				11/17			
Cook	218,662	223,110	227,425	231,462	242,046	(48,409)	[11,618]	{5,809}	253,826	(50,765)	[12,184]	{6,092}	266,928	(53,386)	[12,813]	{6,406}
DuPage	30,244	30,977	31,830	32,487	34,299	(6,860)	[1,646]	{823}	36,321	(7,264)	[1,743]	{872}	38,573	(7,715)	[1,852]	{926}
Kane	22,192	22,579	23,179	23,798	25,130	(5,026)	[1,206]	{603}	26,622	(5,324)	[1,278]	{639}	28,290	(5,658)	[1,358]	{679}
Lake	26,144	26,541	27,189	27,920	29,372	(5,874)	[1,410]	{705}	31,041	(6,208)	[1,490]	{745}	32,955	(6,591)	[1,582]	{791}
McHenry	9,204	9,521	9,786	10,111	10,887	(2,177)	[523]	{261}	11,779	(2,356)	[565]	{283}	12,801	(2,560)	[614]	{307}
Will	24,580	25,132	25,892	26,627	28,300	(5,660)	[1,358]	{679}	30,199	(6,040)	[1,450]	{725}	32,354	(6,471)	[1,553]	{776}

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.