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

Date: 1/8/21

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 1/8/21 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.

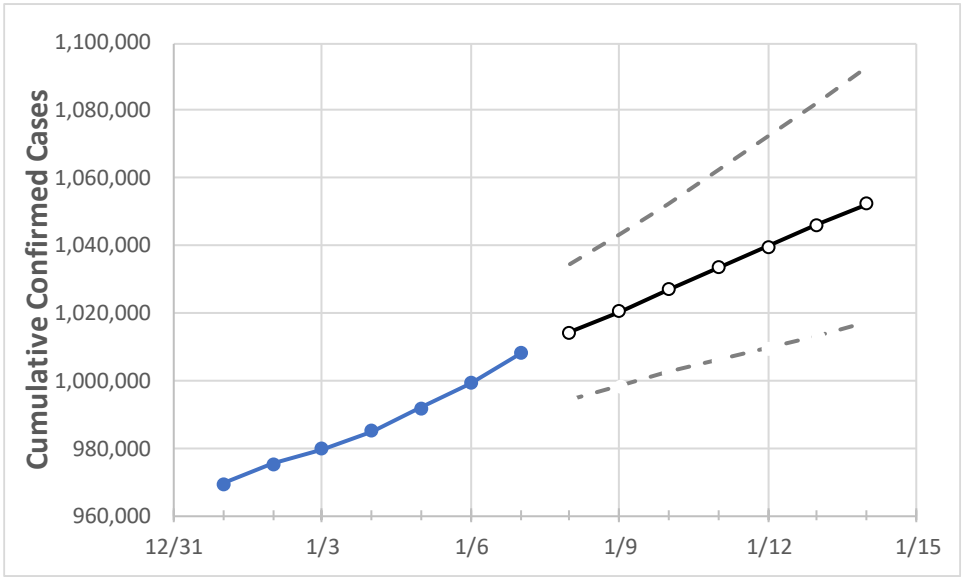
IEM's Modeling Lead

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Illinois	984,880	991,719	999,288	1,008,045	1,014,316	1,020,537	1,027,021	1,033,424	1,039,746	1,046,023	1,052,370

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Cook	401,457	403,987	406,674	410,005	412,250	414,499	416,760	419,050	421,373	423,660	425,945
DuPage	63,396	63,831	64,259	64,755	65,201	65,654	66,110	66,558	67,019	67,492	67,971
Kane	42,355	42,669	42,992	43,351	43,623	43,891	44,159	44,434	44,708	44,986	45,269
Lake	49,151	49,517	49,805	50,213	50,471	50,731	50,989	51,249	51,512	51,773	52,030
McHenry	19,653	19,766	19,885	20,118	20,256	20,396	20,539	20,679	20,822	20,968	21,113
Will	53,443	53,778	54,211	54,678	55,040	55,412	55,783	56,167	56,558	56,947	57,340

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:											
	1/4	1/5	1/6	1/7	1/9				1/11				1/13			
Cook	401,457	403,987	406,674	410,005	414,499	(82,900)	[19,896]	{9,948}	419,050	(83,810)	[20,114]	{10,057}	423,660	(84,732)	[20,336]	{10,168}
DuPage	63,396	63,831	64,259	64,755	65,654	(13,131)	[3,151]	{1,576}	66,558	(13,312)	[3,195]	{1,597}	67,492	(13,498)	[3,240]	{1,620}
Kane	42,355	42,669	42,992	43,351	43,891	(8,778)	[2,107]	{1,053}	44,434	(8,887)	[2,133]	{1,066}	44,986	(8,997)	[2,159]	{1,080}
Lake	49,151	49,517	49,805	50,213	50,731	(10,146)	[2,435]	{1,218}	51,249	(10,250)	[2,460]	{1,230}	51,773	(10,355)	[2,485]	{1,243}
McHenry	19,653	19,766	19,885	20,118	20,396	(4,079)	[979]	{490}	20,679	(4,136)	[993]	{496}	20,968	(4,194)	[1,006]	{503}
Will	53,443	53,778	54,211	54,678	55,412	(11,082)	[2,660]	{1,330}	56,167	(11,233)	[2,696]	{1,348}	56,947	(11,389)	[2,733]	{1,367}

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.