IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/1/20

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 <u>not</u> 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 12/1/20 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
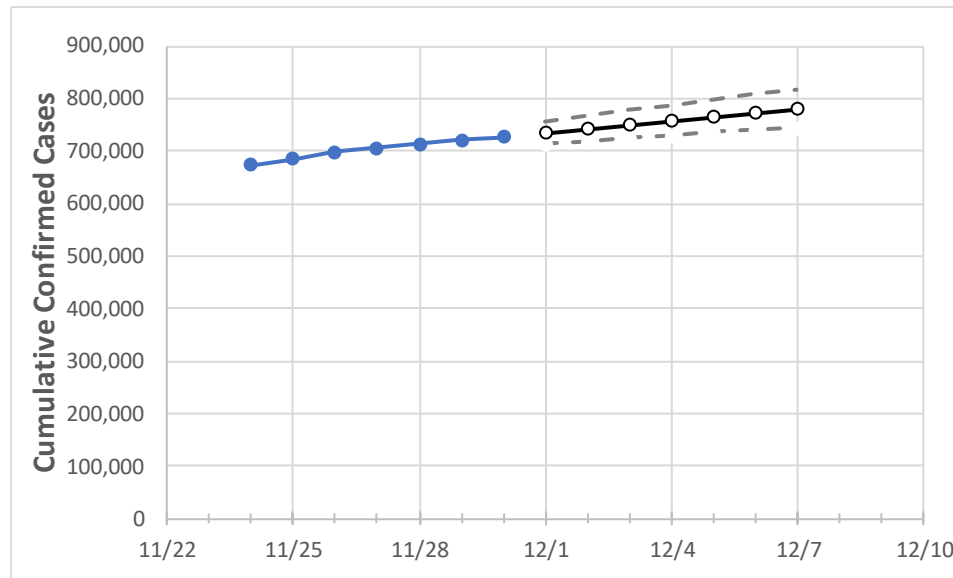
	Actual Confirmed Cases On:				Projected Cases For:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Illinois	705,063	712,936	720,114	726,304	734,377	742,258	749,954	757,468	764,806	771,971	778,968

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:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Cook	298,870	301,582	304,220	306,369	309,276	312,117	314,894	317,608	320,260	322,853	325,387
DuPage	44,035	44,656	45,087	45,446	45,984	46,508	47,019	47,518	48,005	48,480	48,943
Kane	31,136	31,493	31,767	31,955	32,278	32,593	32,900	33,198	33,488	33,770	34,045
Lake	36,375	36,845	37,299	37,596	37,991	38,381	38,765	39,143	39,515	39,882	40,243
McHenry	13,979	14,182	14,269	14,350	14,479	14,603	14,721	14,834	14,943	15,047	15,146
Will	37,864	38,291	38,684	39,020	39,476	39,916	40,342	40,754	41,152	41,537	41,910

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:		
	11/27	11/28	11/29	11/30	12/2	12/4	12/6
Cook	298,870	301,582	304,220	306,369	312,117 (62,423) [14,982] {7,491}	317,608 (63,522) [15,245] {7,623}	322,853 (64,571) [15,497] {7,748}
DuPage	44,035	44,656	45,087	45,446	46,508 (9,302) [2,232] {1,116}	47,518 (9,504) [2,281] {1,140}	48,480 (9,696) [2,327] {1,164}
Kane	31,136	31,493	31,767	31,955	32,593 (6,519) [1,564] {782}	33,198 (6,640) [1,593] {797}	33,770 (6,754) [1,621] {810}
Lake	36,375	36,845	37,299	37,596	38,381 (7,676) [1,842] {921}	39,143 (7,829) [1,879] {939}	39,882 (7,976) [1,914] {957}
McHenry	13,979	14,182	14,269	14,350	14,603 (2,921) [701] {350}	14,834 (2,967) [712] {356}	15,047 (3,009) [722] {361}
Will	37,864	38,291	38,684	39,020	39,916 (7,983) [1,916] {958}	40,754 (8,151) [1,956] {978}	41,537 (8,307) [1,994] {997}

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.