IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/9/20

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 11/9/20 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
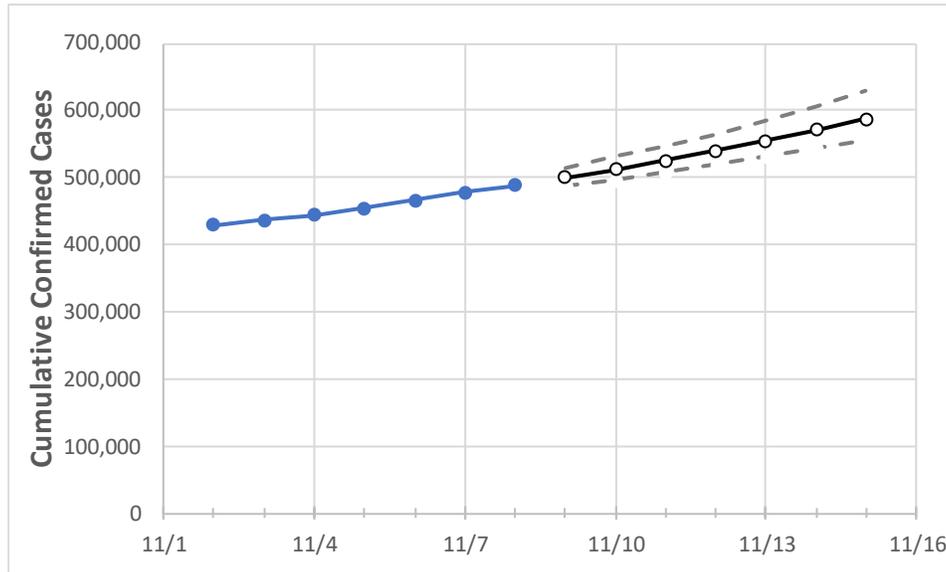
	Actual Confirmed Cases On:				Projected Cases For:						
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15
Illinois	453,738	465,540	477,978	487,987	499,797	512,352	525,698	539,879	554,945	570,947	587,938

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:						
	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15
Cook	204,977	210,266	214,924	218,662	223,270	228,163	233,359	238,875	244,729	250,940	257,529
DuPage	27,584	28,834	29,541	30,244	31,050	31,908	32,822	33,796	34,832	35,935	37,109
Kane	20,127	21,195	21,780	22,192	22,775	23,395	24,056	24,759	25,507	26,303	27,149
Lake	24,105	25,124	25,758	26,144	26,736	27,373	28,058	28,796	29,589	30,443	31,360
McHenry	7,977	8,532	8,895	9,204	9,529	9,880	10,257	10,664	11,103	11,575	12,083
Will	22,323	23,279	24,010	24,580	25,280	26,030	26,834	27,697	28,621	29,612	30,673

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:		
	11/5	11/6	11/7	11/8	11/10	11/12	11/14
Cook	204,977	210,266	214,924	218,662	228,163 (45,633) [10,952] {5,476}	238,875 (47,775) [11,466] {5,733}	250,940 (50,188) [12,045] {6,023}
DuPage	27,584	28,834	29,541	30,244	31,908 (6,382) [1,532] {766}	33,796 (6,759) [1,622] {811}	35,935 (7,187) [1,725] {862}
Kane	20,127	21,195	21,780	22,192	23,395 (4,679) [1,123] {561}	24,759 (4,952) [1,188] {594}	26,303 (5,261) [1,263] {631}
Lake	24,105	25,124	25,758	26,144	27,373 (5,475) [1,314] {657}	28,796 (5,759) [1,382] {691}	30,443 (6,089) [1,461] {731}
McHenry	7,977	8,532	8,895	9,204	9,880 (1,976) [474] {237}	10,664 (2,133) [512] {256}	11,575 (2,315) [556] {278}
Will	22,323	23,279	24,010	24,580	26,030 (5,206) [1,249] {625}	27,697 (5,539) [1,329] {665}	29,612 (5,922) [1,421] {711}

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.