IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/5/21

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 <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 11/5/21 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
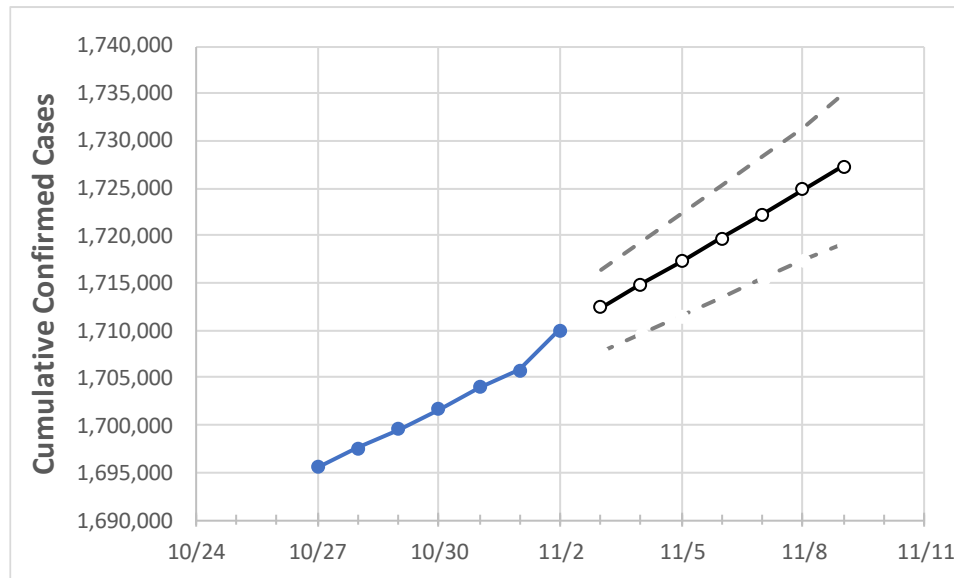
	Actual Confirmed Cases On:				Projected Cases For:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Illinois	1,701,649	1,704,031	1,705,777	1,710,044	1,712,412	1,714,883	1,717,318	1,719,762	1,722,272	1,724,846	1,727,341

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Cook	643,512	644,255	644,617	646,008	646,823	647,650	648,466	649,293	650,142	651,028	651,860
DuPage	110,185	110,357	110,504	110,799	110,991	111,178	111,375	111,566	111,763	111,968	112,172
Kane	69,350	69,437	69,488	69,626	69,708	69,790	69,871	69,952	70,037	70,120	70,202
Lake	81,410	81,496	81,589	81,761	81,888	82,016	82,145	82,278	82,409	82,547	82,681
McHenry	35,474	35,552	35,614	35,734	35,812	35,888	35,968	36,048	36,129	36,215	36,301
Will	92,761	92,932	93,023	93,284	93,431	93,576	93,721	93,872	94,021	94,169	94,326

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:		
	10/30	10/31	11/1	11/2	11/4	11/6	11/8
Cook	643,512	644,255	644,617	646,008	647,650 (129,530) [31,087] {15,544}	649,293 (129,859) [31,166] {15,583}	651,028 (130,206) [31,249] {15,625}
DuPage	110,185	110,357	110,504	110,799	111,178 (22,236) [5,337] {2,668}	111,566 (22,313) [5,355] {2,678}	111,968 (22,394) [5,374] {2,687}
Kane	69,350	69,437	69,488	69,626	69,790 (13,958) [3,350] {1,675}	69,952 (13,990) [3,358] {1,679}	70,120 (14,024) [3,366] {1,683}
Lake	81,410	81,496	81,589	81,761	82,016 (16,403) [3,937] {1,968}	82,278 (16,456) [3,949] {1,975}	82,547 (16,509) [3,962] {1,981}
McHenry	35,474	35,552	35,614	35,734	35,888 (7,178) [1,723] {861}	36,048 (7,210) [1,730] {865}	36,215 (7,243) [1,738] {869}
Will	92,761	92,932	93,023	93,284	93,576 (18,715) [4,492] {2,246}	93,872 (18,774) [4,506] {2,253}	94,169 (18,834) [4,520] {2,260}

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.