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

Date: 12/14/20

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 12/14/20 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.

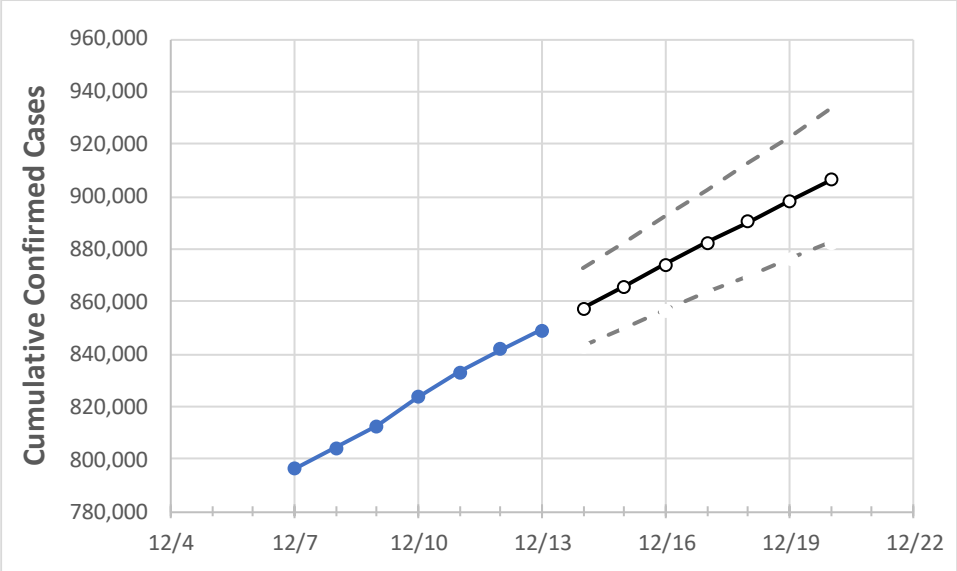
IEM's Modeling Lead

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:						
	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20
Illinois	823,531	832,951	841,688	848,904	857,340	865,707	874,005	882,234	890,394	898,484	906,505

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:						
	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20
Cook	342,654	346,004	349,461	352,409	355,637	358,854	362,059	365,251	368,431	371,598	374,753
DuPage	52,882	53,456	54,080	54,533	55,112	55,686	56,255	56,820	57,381	57,936	58,487
Kane	35,872	36,193	36,498	36,780	37,095	37,406	37,715	38,020	38,322	38,620	38,916
Lake	42,110	42,410	42,727	43,088	43,455	43,817	44,174	44,526	44,873	45,215	45,553
McHenry	16,086	16,227	16,388	16,561	16,711	16,860	17,009	17,156	17,303	17,449	17,594
Will	44,883	45,363	45,881	46,265	46,717	47,164	47,605	48,041	48,471	48,895	49,315

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:		
	12/10	12/11	12/12	12/13	12/15	12/17	12/19
Cook	342,654	346,004	349,461	352,409	358,854 (71,771) [17,225] {8,612}	365,251 (73,050) [17,532] {8,766}	371,598 (74,320) [17,837] {8,918}
DuPage	52,882	53,456	54,080	54,533	55,686 (11,137) [2,673] {1,336}	56,820 (11,364) [2,727] {1,364}	57,936 (11,587) [2,781] {1,390}
Kane	35,872	36,193	36,498	36,780	37,406 (7,481) [1,796] {898}	38,020 (7,604) [1,825] {912}	38,620 (7,724) [1,854] {927}
Lake	42,110	42,410	42,727	43,088	43,817 (8,763) [2,103] {1,052}	44,526 (8,905) [2,137] {1,069}	45,215 (9,043) [2,170] {1,085}
McHenry	16,086	16,227	16,388	16,561	16,860 (3,372) [809] {405}	17,156 (3,431) [824] {412}	17,449 (3,490) [838] {419}
Will	44,883	45,363	45,881	46,265	47,164 (9,433) [2,264] {1,132}	48,041 (9,608) [2,306] {1,153}	48,895 (9,779) [2,347] {1,173}

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.