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

Date: 12/10/21

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 12/10/21 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.

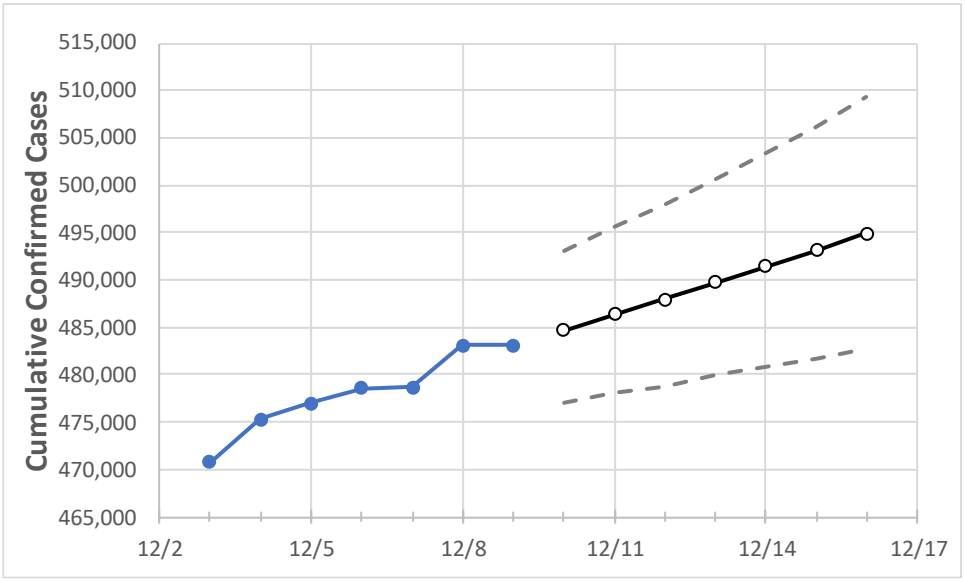
IEM's Modeling Lead

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.

Kansas State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Kansas	478,613	478,634	483,062	483,101	484,706	486,334	487,967	489,716	491,456	493,129	494,926

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.

Kansas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Douglas	13,488	13,527	13,565	13,565	13,613	13,660	13,710	13,760	13,815	13,867	13,923
Johnson	84,641	84,979	85,316	85,316	85,651	86,007	86,357	86,736	87,117	87,505	87,913
Leavenworth	11,414	11,460	11,505	11,505	11,550	11,597	11,645	11,694	11,744	11,795	11,847
Sedgwick	88,738	89,104	89,469	89,469	89,784	90,103	90,436	90,774	91,125	91,478	91,838
Wyandotte	29,602	29,683	29,763	29,763	29,846	29,932	30,020	30,114	30,208	30,305	30,406

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.*

Kansas Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	12/6	12/7	12/8	12/9	12/11	12/13	12/15
Douglas	13,488	13,527	13,565	13,565	13,660 (2,732) [656] {328}	13,760 (2,752) [660] {330}	13,867 (2,773) [666] {333}
Johnson	84,641	84,979	85,316	85,316	86,007 (17,201) [4,128] {2,064}	86,736 (17,347) [4,163] {2,082}	87,505 (17,501) [4,200] {2,100}
Leavenworth	11,414	11,460	11,505	11,505	11,597 (2,319) [557] {278}	11,694 (2,339) [561] {281}	11,795 (2,359) [566] {283}
Sedgwick	88,738	89,104	89,469	89,469	90,103 (18,021) [4,325] {2,162}	90,774 (18,155) [4,357] {2,179}	91,478 (18,296) [4,391] {2,195}
Wyandotte	29,602	29,683	29,763	29,763	29,932 (5,986) [1,437] {718}	30,114 (6,023) [1,445] {723}	30,305 (6,061) [1,455] {727}

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.