IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/29/21

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 12/29/21 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.

Connecticut State Projections
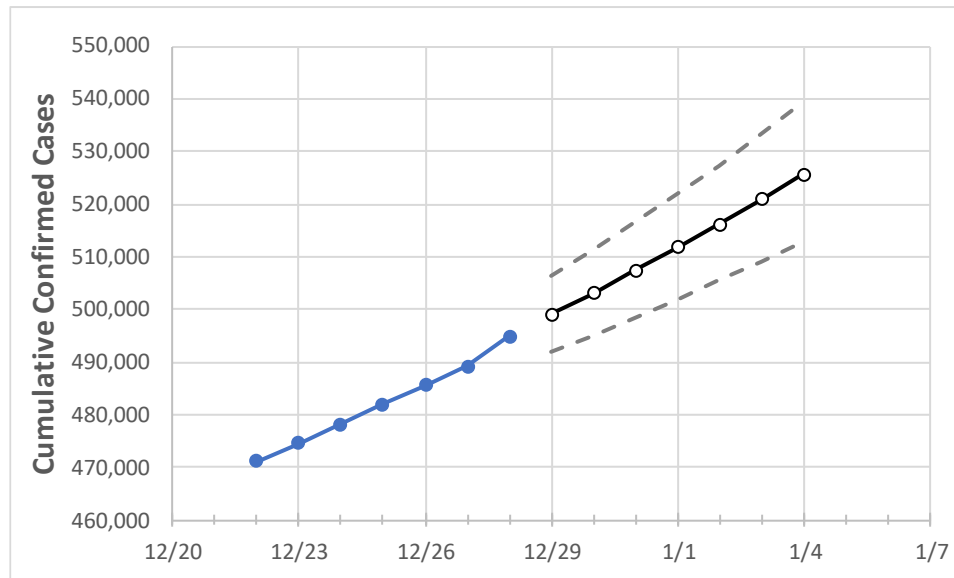
	Actual Confirmed Cases On:				Projected Cases For:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Connecticut	481,884	485,548	489,211	494,964	498,960	503,063	507,417	511,744	516,198	520,845	525,584

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.

Connecticut Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Fairfield	131,554	132,890	134,225	135,622	137,064	138,607	140,210	141,903	143,686	145,520	147,461
Hartford	117,257	118,041	118,824	120,659	121,531	122,409	123,341	124,260	125,244	126,261	127,224
Litchfield	21,475	21,597	21,719	21,929	22,076	22,225	22,377	22,530	22,683	22,846	23,001
Middlesex	18,045	18,145	18,244	18,372	18,494	18,620	18,751	18,875	19,007	19,154	19,286
New Haven	126,160	127,076	127,993	129,536	130,670	131,804	132,901	134,123	135,323	136,604	137,913
Tolland	13,935	14,007	14,079	14,224	14,305	14,389	14,474	14,556	14,642	14,727	14,816

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.*

Connecticut Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	12/25	12/26	12/27	12/28	12/30	1/1	1/3
Fairfield	131,554	132,890	134,225	135,622	138,607 (27,721) [6,653] {3,327}	141,903 (28,381) [6,811] {3,406}	145,520 (29,104) [6,985] {3,492}
Hartford	117,257	118,041	118,824	120,659	122,409 (24,482) [5,876] {2,938}	124,260 (24,852) [5,964] {2,982}	126,261 (25,252) [6,061] {3,030}
Litchfield	21,475	21,597	21,719	21,929	22,225 (4,445) [1,067] {533}	22,530 (4,506) [1,081] {541}	22,846 (4,569) [1,097] {548}
Middlesex	18,045	18,145	18,244	18,372	18,620 (3,724) [894] {447}	18,875 (3,775) [906] {453}	19,154 (3,831) [919] {460}
New Haven	126,160	127,076	127,993	129,536	131,804 (26,361) [6,327] {3,163}	134,123 (26,825) [6,438] {3,219}	136,604 (27,321) [6,557] {3,278}
Tolland	13,935	14,007	14,079	14,224	14,389 (2,878) [691] {345}	14,556 (2,911) [699] {349}	14,727 (2,945) [707] {353}

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.