IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/6/21

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 8/6/21 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
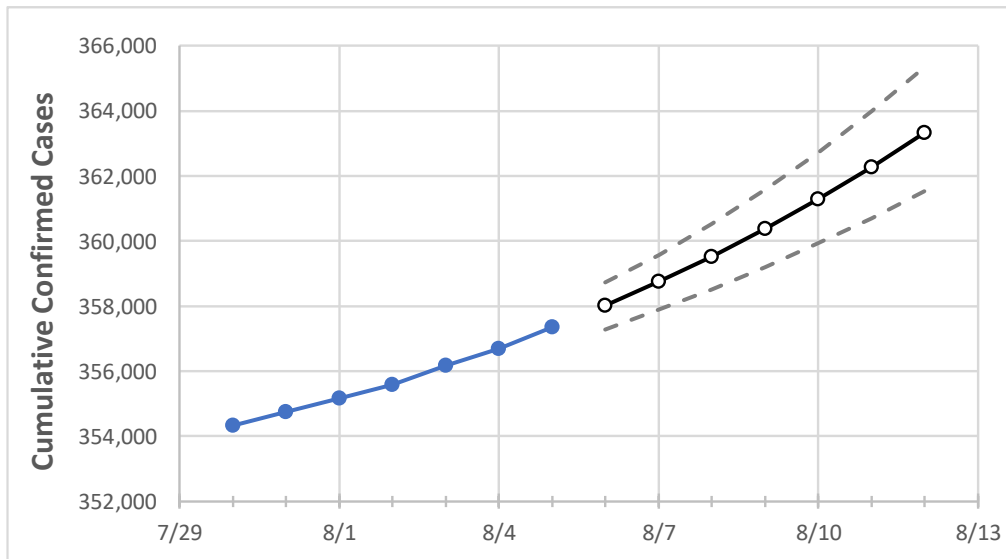
	Actual Confirmed Cases On:				Projected Cases For:						
	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12
Connecticut	355,580	356,164	356,701	357,345	358,020	358,743	359,523	360,369	361,289	362,270	363,333

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:						
	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11	8/12
Fairfield	101,975	102,136	102,265	102,430	102,599	102,783	102,982	103,200	103,437	103,694	103,969
Hartford	86,314	86,424	86,573	86,759	86,936	87,127	87,337	87,561	87,797	88,051	88,326
Litchfield	14,908	14,929	14,947	14,964	14,985	15,009	15,035	15,062	15,093	15,126	15,160
Middlesex	13,138	13,160	13,174	13,203	13,230	13,260	13,291	13,324	13,360	13,400	13,443
New Haven	93,986	94,202	94,378	94,526	94,723	94,937	95,172	95,428	95,707	96,011	96,344
Tolland	9,865	9,879	9,884	9,904	9,921	9,940	9,960	9,980	10,002	10,026	10,050

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:		
	8/2	8/3	8/4	8/5	8/7	8/9	8/11
Fairfield	101,975	102,136	102,265	102,430	102,783 (20,557) [4,934] {2,467}	103,200 (20,640) [4,954] {2,477}	103,694 (20,739) [4,977] {2,489}
Hartford	86,314	86,424	86,573	86,759	87,127 (17,425) [4,182] {2,091}	87,561 (17,512) [4,203] {2,101}	88,051 (17,610) [4,226] {2,113}
Litchfield	14,908	14,929	14,947	14,964	15,009 (3,002) [720] {360}	15,062 (3,012) [723] {361}	15,126 (3,025) [726] {363}
Middlesex	13,138	13,160	13,174	13,203	13,260 (2,652) [636] {318}	13,324 (2,665) [640] {320}	13,400 (2,680) [643] {322}
New Haven	93,986	94,202	94,378	94,526	94,937 (18,987) [4,557] {2,278}	95,428 (19,086) [4,581] {2,290}	96,011 (19,202) [4,609] {2,304}
Tolland	9,865	9,879	9,884	9,904	9,940 (1,988) [477] {239}	9,980 (1,996) [479] {240}	10,026 (2,005) [481] {241}

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.