IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/8/21

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 4/8/21 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
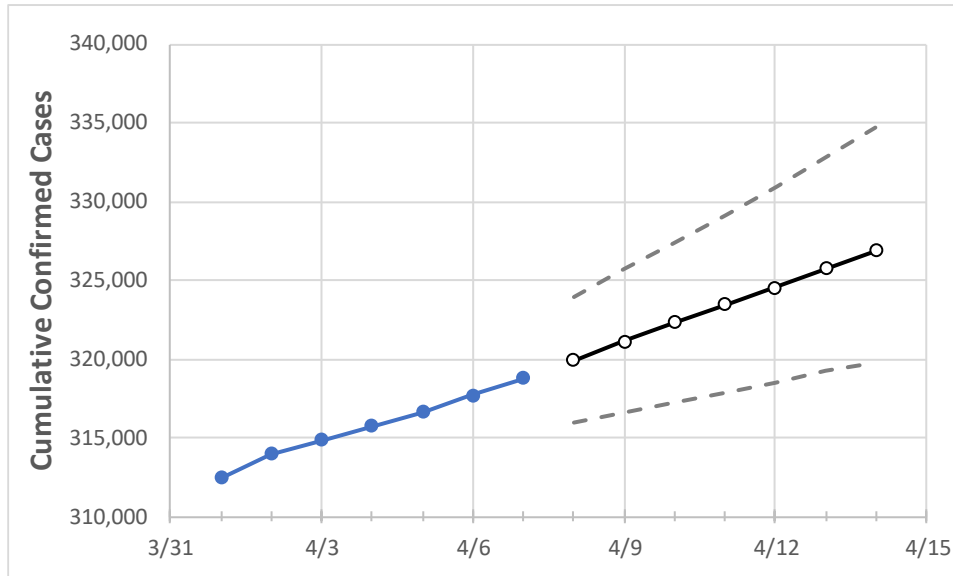
	Actual Confirmed Cases On:				Projected Cases For:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
Connecticut	315,755	316,655	317,729	318,767	319,935	321,119	322,299	323,435	324,565	325,716	326,854

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:						
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14
Fairfield	91,088	91,364	91,622	91,935	92,259	92,582	92,896	93,211	93,514	93,826	94,123
Hartford	76,673	76,839	77,133	77,304	77,528	77,751	77,977	78,197	78,419	78,639	78,859
Litchfield	13,165	13,216	13,282	13,363	13,431	13,499	13,566	13,632	13,697	13,761	13,827
Middlesex	11,743	11,781	11,820	11,838	11,877	11,915	11,954	11,992	12,031	12,067	12,105
New Haven	82,365	82,651	82,967	83,315	83,678	84,047	84,413	84,775	85,148	85,521	85,888
Tolland	8,728	8,747	8,783	8,826	8,860	8,894	8,929	8,964	9,001	9,036	9,072

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:		
	4/4	4/5	4/6	4/7	4/9	4/11	4/13
Fairfield	91,088	91,364	91,622	91,935	92,582 (18,516) [4,444] {2,222}	93,211 (18,642) [4,474] {2,237}	93,826 (18,765) [4,504] {2,252}
Hartford	76,673	76,839	77,133	77,304	77,751 (15,550) [3,732] {1,866}	78,197 (15,639) [3,753] {1,877}	78,639 (15,728) [3,775] {1,887}
Litchfield	13,165	13,216	13,282	13,363	13,499 (2,700) [648] {324}	13,632 (2,726) [654] {327}	13,761 (2,752) [661] {330}
Middlesex	11,743	11,781	11,820	11,838	11,915 (2,383) [572] {286}	11,992 (2,398) [576] {288}	12,067 (2,413) [579] {290}
New Haven	82,365	82,651	82,967	83,315	84,047 (16,809) [4,034] {2,017}	84,775 (16,955) [4,069] {2,035}	85,521 (17,104) [4,105] {2,053}
Tolland	8,728	8,747	8,783	8,826	8,894 (1,779) [427] {213}	8,964 (1,793) [430] {215}	9,036 (1,807) [434] {217}

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.