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

Date: 3/26/21

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 3/26/21 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.

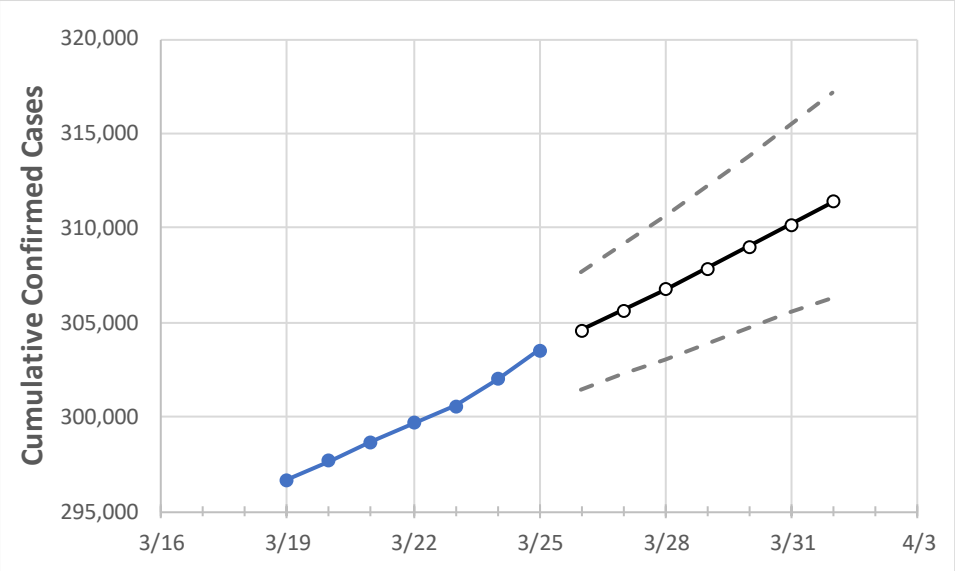
IEM's Modeling Lead

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Connecticut	299,667	300,565	302,022	303,510	304,587	305,661	306,745	307,873	309,020	310,190	311,389

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Fairfield	86,134	86,392	86,878	87,366	87,719	88,080	88,457	88,835	89,221	89,632	90,049
Hartford	73,683	73,835	74,073	74,346	74,547	74,754	74,961	75,176	75,391	75,613	75,831
Litchfield	12,145	12,195	12,286	12,388	12,470	12,555	12,644	12,737	12,833	12,936	13,043
Middlesex	11,173	11,216	11,248	11,299	11,338	11,377	11,417	11,457	11,498	11,540	11,582
New Haven	77,335	77,638	78,094	78,536	78,852	79,170	79,497	79,833	80,168	80,511	80,857
Tolland	8,332	8,356	8,384	8,416	8,439	8,462	8,485	8,508	8,531	8,555	8,578

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:		
	3/22	3/23	3/24	3/25	3/27	3/29	3/31
Fairfield	86,134	86,392	86,878	87,366	88,080 (17,616) [4,228] {2,114}	88,835 (17,767) [4,264] {2,132}	89,632 (17,926) [4,302] {2,151}
Hartford	73,683	73,835	74,073	74,346	74,754 (14,951) [3,588] {1,794}	75,176 (15,035) [3,608] {1,804}	75,613 (15,123) [3,629] {1,815}
Litchfield	12,145	12,195	12,286	12,388	12,555 (2,511) [603] {301}	12,737 (2,547) [611] {306}	12,936 (2,587) [621] {310}
Middlesex	11,173	11,216	11,248	11,299	11,377 (2,275) [546] {273}	11,457 (2,291) [550] {275}	11,540 (2,308) [554] {277}
New Haven	77,335	77,638	78,094	78,536	79,170 (15,834) [3,800] {1,900}	79,833 (15,967) [3,832] {1,916}	80,511 (16,102) [3,865] {1,932}
Tolland	8,332	8,356	8,384	8,416	8,462 (1,692) [406] {203}	8,508 (1,702) [408] {204}	8,555 (1,711) [411] {205}

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.