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

Date: 3/29/21

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 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 3/29/21 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.

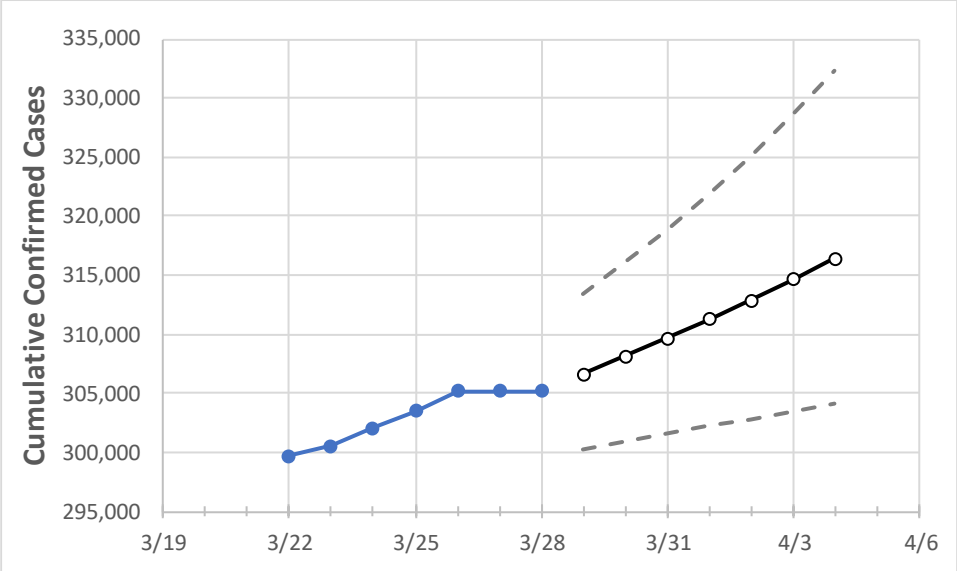
IEM's Modeling Lead

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Connecticut	303,510	305,210	305,210	305,210	306,633	308,137	309,692	311,278	312,901	314,623	316,434

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Fairfield	87,366	87,890	87,890	87,890	88,351	88,828	89,316	89,817	90,351	90,887	91,455
Hartford	74,346	74,654	74,654	74,654	74,931	75,215	75,510	75,820	76,135	76,464	76,799
Litchfield	12,388	12,518	12,518	12,518	12,634	12,757	12,884	13,023	13,168	13,323	13,491
Middlesex	11,299	11,364	11,364	11,364	11,406	11,451	11,497	11,543	11,592	11,637	11,684
New Haven	78,536	79,060	79,060	79,060	79,488	79,927	80,390	80,852	81,347	81,851	82,364
Tolland	8,416	8,457	8,457	8,457	8,484	8,511	8,538	8,566	8,595	8,624	8,652

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:		
	3/25	3/26	3/27	3/28	3/30	4/1	4/3
Fairfield	87,366	87,890	87,890	87,890	88,828 (17,766) [4,264] {2,132}	89,817 (17,963) [4,311] {2,156}	90,887 (18,177) [4,363] {2,181}
Hartford	74,346	74,654	74,654	74,654	75,215 (15,043) [3,610] {1,805}	75,820 (15,164) [3,639] {1,820}	76,464 (15,293) [3,670] {1,835}
Litchfield	12,388	12,518	12,518	12,518	12,757 (2,551) [612] {306}	13,023 (2,605) [625] {313}	13,323 (2,665) [639] {320}
Middlesex	11,299	11,364	11,364	11,364	11,451 (2,290) [550] {275}	11,543 (2,309) [554] {277}	11,637 (2,327) [559] {279}
New Haven	78,536	79,060	79,060	79,060	79,927 (15,985) [3,836] {1,918}	80,852 (16,170) [3,881] {1,940}	81,851 (16,370) [3,929] {1,964}
Tolland	8,416	8,457	8,457	8,457	8,511 (1,702) [409] {204}	8,566 (1,713) [411] {206}	8,624 (1,725) [414] {207}

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.