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

Date: 3/29/22

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 3/29/22 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.

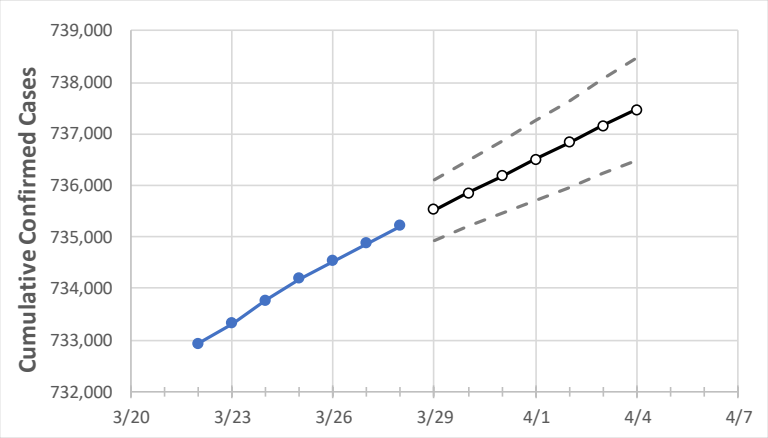
IEM's Modeling Lead

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	734,196	734,534	734,872	735,210	735,527	735,860	736,177	736,508	736,831	737,156	737,476

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	201,183	201,289	201,396	201,502	201,601	201,706	201,806	201,912	202,017	202,121	202,224
Hartford	176,101	176,182	176,262	176,343	176,416	176,487	176,560	176,634	176,710	176,786	176,861
Litchfield	31,521	31,540	31,560	31,579	31,594	31,608	31,622	31,637	31,651	31,666	31,681
Middlesex	27,873	27,886	27,898	27,911	27,924	27,937	27,950	27,963	27,975	27,988	28,000
New Haven	194,335	194,412	194,490	194,567	194,648	194,731	194,812	194,892	194,973	195,052	195,128
Tolland	20,353	20,365	20,377	20,389	20,401	20,414	20,426	20,439	20,451	20,464	20,478

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	201,183	201,289	201,396	201,502	201,706 (40,341) [9,682] {4,841}	201,912 (40,382) [9,692] {4,846}	202,121 (40,424) [9,702] {4,851}
Hartford	176,101	176,182	176,262	176,343	176,487 (35,297) [8,471] {4,236}	176,634 (35,327) [8,478] {4,239}	176,786 (35,357) [8,486] {4,243}
Litchfield	31,521	31,540	31,560	31,579	31,608 (6,322) [1,517] {759}	31,637 (6,327) [1,519] {759}	31,666 (6,333) [1,520] {760}
Middlesex	27,873	27,886	27,898	27,911	27,937 (5,587) [1,341] {670}	27,963 (5,593) [1,342] {671}	27,988 (5,598) [1,343] {672}
New Haven	194,335	194,412	194,490	194,567	194,731 (38,946) [9,347] {4,674}	194,892 (38,978) [9,355] {4,677}	195,052 (39,010) [9,363] {4,681}
Tolland	20,353	20,365	20,377	20,389	20,414 (4,083) [980] {490}	20,439 (4,088) [981] {491}	20,464 (4,093) [982] {491}

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.