

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

Date: 2/16/21

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 2/16/21 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.

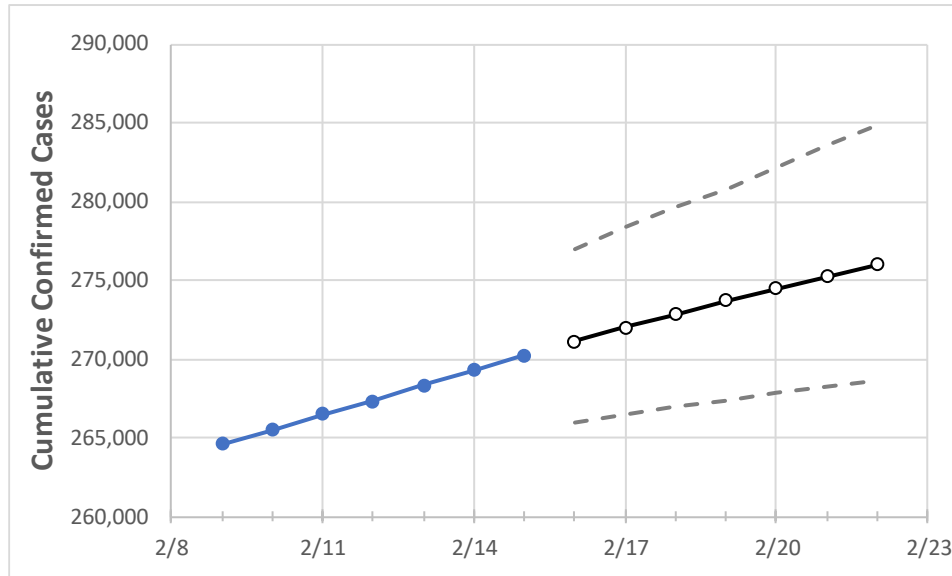
IEM's Modeling Lead

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:					
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Connecticut	267,337	268,305	269,274	270,242	271,121	271,996	272,852	273,726	274,497	275,242	275,972

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Fairfield	76,511	76,763	77,014	77,266	77,512	77,760	77,997	78,237	78,463	78,678	78,905
Hartford	67,328	67,550	67,772	67,994	68,198	68,392	68,579	68,753	68,926	69,096	69,254
Litchfield	10,604	10,639	10,675	10,710	10,748	10,785	10,821	10,857	10,892	10,928	10,962
Middlesex	9,868	9,911	9,955	9,998	10,034	10,067	10,101	10,135	10,168	10,200	10,232
New Haven	67,586	67,870	68,153	68,437	68,688	68,936	69,179	69,411	69,639	69,857	70,072
Tolland	7,445	7,472	7,500	7,527	7,555	7,584	7,612	7,638	7,664	7,689	7,713

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:											
	2/12	2/13	2/14	2/15	2/17			2/19			2/21					
Fairfield	76,511	76,763	77,014	77,266	77,760	(15,552)	[3,732]	{1,866}	78,237	(15,647)	[3,755]	{1,878}	78,678	(15,736)	[3,777]	{1,888}
Hartford	67,328	67,550	67,772	67,994	68,392	(13,678)	[3,283]	{1,641}	68,753	(13,751)	[3,300]	{1,650}	69,096	(13,819)	[3,317]	{1,658}
Litchfield	10,604	10,639	10,675	10,710	10,785	(2,157)	[518]	{259}	10,857	(2,171)	[521]	{261}	10,928	(2,186)	[525]	{262}
Middlesex	9,868	9,911	9,955	9,998	10,067	(2,013)	[483]	{242}	10,135	(2,027)	[486]	{243}	10,200	(2,040)	[490]	{245}
New Haven	67,586	67,870	68,153	68,437	68,936	(13,787)	[3,309]	{1,654}	69,411	(13,882)	[3,332]	{1,666}	69,857	(13,971)	[3,353]	{1,677}
Tolland	7,445	7,472	7,500	7,527	7,584	(1,517)	[364]	{182}	7,638	(1,528)	[367]	{183}	7,689	(1,538)	[369]	{185}

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.