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

Date: 4/2/21

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 4/2/21 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.

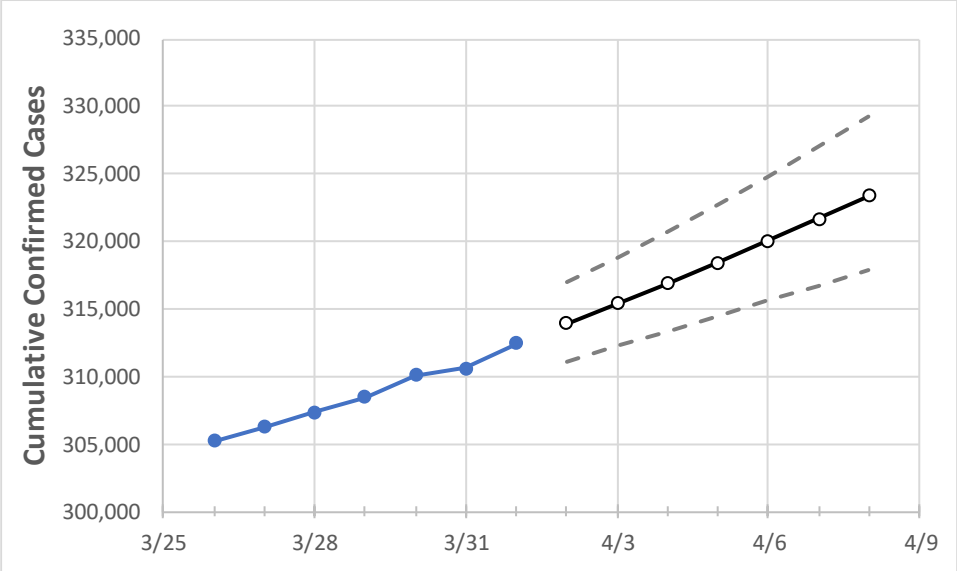
IEM's Modeling Lead

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Connecticut	308,439	310,056	310,624	312,468	313,908	315,386	316,891	318,466	320,040	321,686	323,373

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Fairfield	88,876	89,346	89,598	90,096	90,545	91,007	91,479	91,960	92,451	92,957	93,474
Hartford	75,294	75,665	75,802	76,038	76,302	76,577	76,866	77,158	77,452	77,754	78,071
Litchfield	12,713	12,805	12,872	12,995	13,098	13,206	13,317	13,435	13,553	13,677	13,808
Middlesex	11,475	11,529	11,552	11,611	11,657	11,704	11,751	11,801	11,849	11,898	11,950
New Haven	80,047	80,542	80,930	81,318	81,759	82,218	82,688	83,176	83,673	84,179	84,697
Tolland	8,536	8,589	8,614	8,653	8,686	8,721	8,755	8,791	8,828	8,866	8,904

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:		
	3/29	3/30	3/31	4/1	4/3	4/5	4/7
Fairfield	88,876	89,346	89,598	90,096	91,007 (18,201) [4,368] {2,184}	91,960 (18,392) [4,414] {2,207}	92,957 (18,591) [4,462] {2,231}
Hartford	75,294	75,665	75,802	76,038	76,577 (15,315) [3,676] {1,838}	77,158 (15,432) [3,704] {1,852}	77,754 (15,551) [3,732] {1,866}
Litchfield	12,713	12,805	12,872	12,995	13,206 (2,641) [634] {317}	13,435 (2,687) [645] {322}	13,677 (2,735) [657] {328}
Middlesex	11,475	11,529	11,552	11,611	11,704 (2,341) [562] {281}	11,801 (2,360) [566] {283}	11,898 (2,380) [571] {286}
New Haven	80,047	80,542	80,930	81,318	82,218 (16,444) [3,946] {1,973}	83,176 (16,635) [3,992] {1,996}	84,179 (16,836) [4,041] {2,020}
Tolland	8,536	8,589	8,614	8,653	8,721 (1,744) [419] {209}	8,791 (1,758) [422] {211}	8,866 (1,773) [426] {213}

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.