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

Date: 5/4/21

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 5/4/21 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.

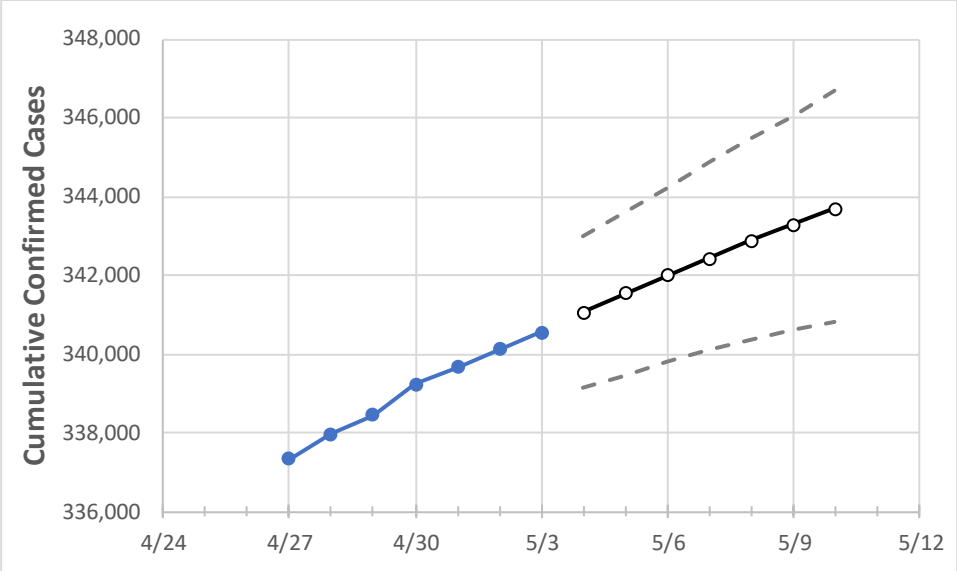
IEM's Modeling Lead

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:						
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10
Connecticut	339,233	339,670	340,108	340,545	341,047	341,526	341,995	342,433	342,872	343,295	343,701

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:						
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10
Fairfield	98,131	98,235	98,339	98,443	98,556	98,663	98,763	98,856	98,945	99,030	99,111
Hartford	81,660	81,777	81,893	82,010	82,137	82,258	82,378	82,493	82,606	82,718	82,828
Litchfield	14,323	14,339	14,355	14,371	14,390	14,408	14,426	14,443	14,460	14,475	14,490
Middlesex	12,547	12,554	12,561	12,568	12,582	12,595	12,608	12,620	12,632	12,643	12,654
New Haven	89,526	89,655	89,784	89,913	90,070	90,221	90,369	90,511	90,645	90,775	90,900
Tolland	9,350	9,364	9,378	9,392	9,406	9,420	9,433	9,446	9,459	9,471	9,483

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:		
	4/30	5/1	5/2	5/3	5/5	5/7	5/9
Fairfield	98,131	98,235	98,339	98,443	98,663 (19,733) [4,736] {2,368}	98,856 (19,771) [4,745] {2,373}	99,030 (19,806) [4,753] {2,377}
Hartford	81,660	81,777	81,893	82,010	82,258 (16,452) [3,948] {1,974}	82,493 (16,499) [3,960] {1,980}	82,718 (16,544) [3,970] {1,985}
Litchfield	14,323	14,339	14,355	14,371	14,408 (2,882) [692] {346}	14,443 (2,889) [693] {347}	14,475 (2,895) [695] {347}
Middlesex	12,547	12,554	12,561	12,568	12,595 (2,519) [605] {302}	12,620 (2,524) [606] {303}	12,643 (2,529) [607] {303}
New Haven	89,526	89,655	89,784	89,913	90,221 (18,044) [4,331] {2,165}	90,511 (18,102) [4,345] {2,172}	90,775 (18,155) [4,357] {2,179}
Tolland	9,350	9,364	9,378	9,392	9,420 (1,884) [452] {226}	9,446 (1,889) [453] {227}	9,471 (1,894) [455] {227}

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.