

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

Date: 3/8/21

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 3/8/21 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.

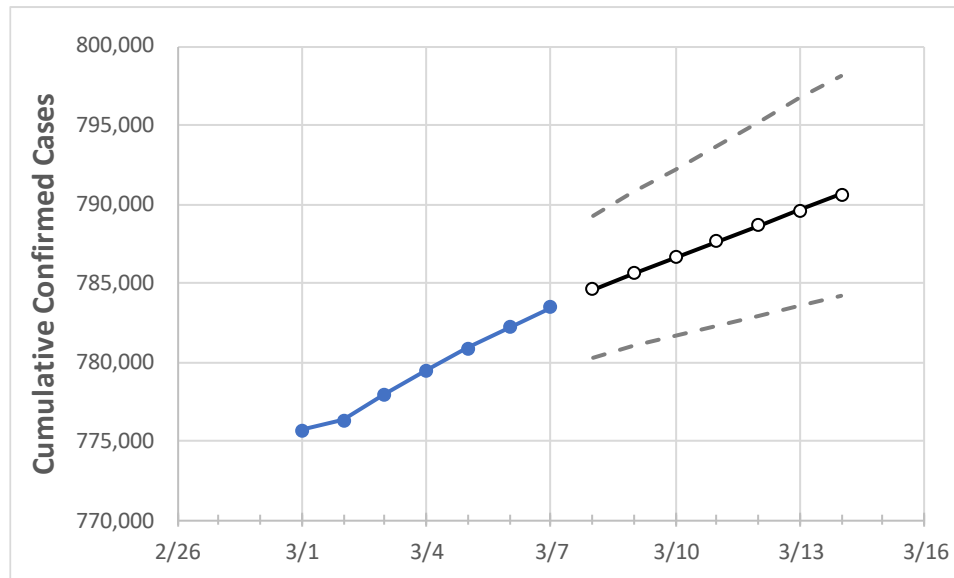
IEM's Modeling Lead

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.

Tennessee State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Tennessee	779,449	780,894	782,206	783,484	784,579	785,627	786,637	787,640	788,648	789,613	790,613

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.

Tennessee Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Blount	14,141	14,167	14,189	14,213	14,231	14,250	14,267	14,284	14,301	14,317	14,332
Davidson	81,809	81,978	82,125	82,248	82,351	82,449	82,548	82,644	82,736	82,823	82,906
Hamilton	40,539	40,635	40,698	40,761	40,821	40,878	40,934	40,988	41,041	41,093	41,143
Knox	46,250	46,346	46,447	46,569	46,668	46,766	46,864	46,957	47,048	47,137	47,226
Rutherford	38,563	38,663	38,749	38,847	38,921	38,994	39,065	39,135	39,204	39,270	39,336
Shelby	87,618	87,755	87,879	88,022	88,124	88,225	88,317	88,411	88,502	88,585	88,666
Sumner	21,448	21,498	21,542	21,597	21,635	21,674	21,712	21,749	21,788	21,826	21,864
Williamson	25,382	25,433	25,489	25,536	25,576	25,616	25,653	25,689	25,725	25,759	25,791

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.

Tennessee Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:											
	3/4	3/5	3/6	3/7	3/9				3/11				3/13			
Blount	14,141	14,167	14,189	14,213	14,250	(2,850)	[684]	{342}	14,284	(2,857)	[686]	{343}	14,317	(2,863)	[687]	{344}
Davidson	81,809	81,978	82,125	82,248	82,449	(16,490)	[3,958]	{1,979}	82,644	(16,529)	[3,967]	{1,983}	82,823	(16,565)	[3,976]	{1,988}
Hamilton	40,539	40,635	40,698	40,761	40,878	(8,176)	[1,962]	{981}	40,988	(8,198)	[1,967]	{984}	41,093	(8,219)	[1,972]	{986}
Knox	46,250	46,346	46,447	46,569	46,766	(9,353)	[2,245]	{1,122}	46,957	(9,391)	[2,254]	{1,127}	47,137	(9,427)	[2,263]	{1,131}
Rutherford	38,563	38,663	38,749	38,847	38,994	(7,799)	[1,872]	{936}	39,135	(7,827)	[1,878]	{939}	39,270	(7,854)	[1,885]	{942}
Shelby	87,618	87,755	87,879	88,022	88,225	(17,645)	[4,235]	{2,117}	88,411	(17,682)	[4,244]	{2,122}	88,585	(17,717)	[4,252]	{2,126}
Sumner	21,448	21,498	21,542	21,597	21,674	(4,335)	[1,040]	{520}	21,749	(4,350)	[1,044]	{522}	21,826	(4,365)	[1,048]	{524}
Williamson	25,382	25,433	25,489	25,536	25,616	(5,123)	[1,230]	{615}	25,689	(5,138)	[1,233]	{617}	25,759	(5,152)	[1,236]	{618}

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.