

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 7/21/21**

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 7/21/21 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.

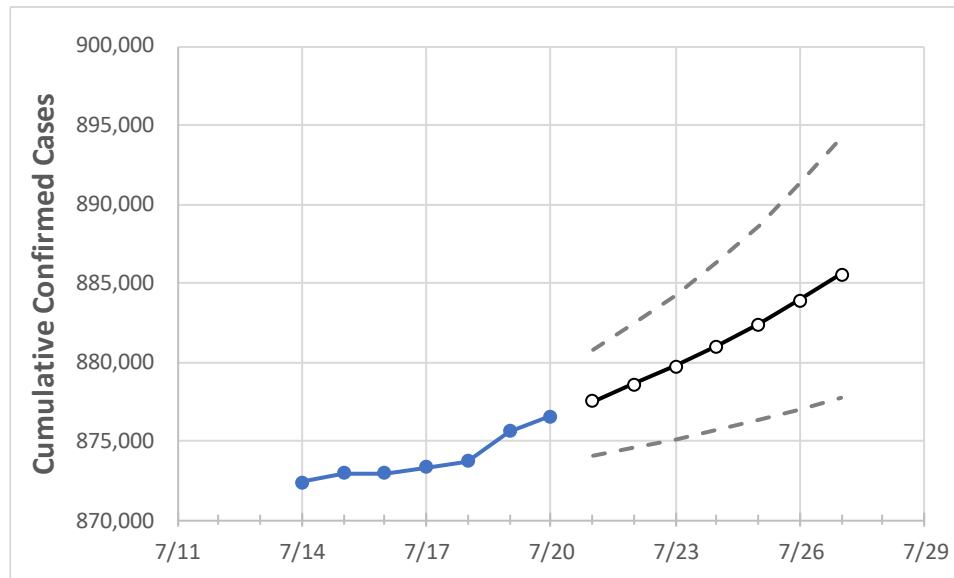
IEM's Modeling Lead

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Tennessee	873,315	873,685	875,628	876,543	877,516	878,599	879,753	881,013	882,395	883,898	885,549

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Blount	16,037	16,042	16,069	16,079	16,092	16,105	16,119	16,134	16,150	16,167	16,184
Davidson	90,959	90,982	91,136	91,206	91,287	91,374	91,467	91,567	91,679	91,797	91,921
Hamilton	45,868	45,882	45,994	46,037	46,093	46,151	46,214	46,280	46,351	46,424	46,505
Knox	52,347	52,361	52,462	52,512	52,560	52,611	52,668	52,728	52,794	52,865	52,942
Rutherford	43,934	43,943	44,034	44,081	44,119	44,160	44,205	44,254	44,307	44,364	44,426
Shelby	100,360	100,409	100,878	101,038	101,257	101,489	101,740	102,003	102,291	102,591	102,915
Sumner	24,853	24,864	24,940	24,971	25,011	25,053	25,099	25,148	25,200	25,256	25,315
Williamson	28,855	28,865	28,933	28,971	29,001	29,033	29,069	29,107	29,148	29,193	29,243

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:											
	7/17	7/18	7/19	7/20	7/22				7/24				7/26			
Blount	16,037	16,042	16,069	16,079	16,105	(3,221)	[773]	{387}	16,134	(3,227)	[774]	{387}	16,167	(3,233)	[776]	{388}
Davidson	90,959	90,982	91,136	91,206	91,374	(18,275)	[4,386]	{2,193}	91,567	(18,313)	[4,395]	{2,198}	91,797	(18,359)	[4,406]	{2,203}
Hamilton	45,868	45,882	45,994	46,037	46,151	(9,230)	[2,215]	{1,108}	46,280	(9,256)	[2,221]	{1,111}	46,424	(9,285)	[2,228]	{1,114}
Knox	52,347	52,361	52,462	52,512	52,611	(10,522)	[2,525]	{1,263}	52,728	(10,546)	[2,531]	{1,265}	52,865	(10,573)	[2,537]	{1,269}
Rutherford	43,934	43,943	44,034	44,081	44,160	(8,832)	[2,120]	{1,060}	44,254	(8,851)	[2,124]	{1,062}	44,364	(8,873)	[2,129]	{1,065}
Shelby	100,360	100,409	100,878	101,038	101,489	(20,298)	[4,871]	{2,436}	102,003	(20,401)	[4,896]	{2,448}	102,591	(20,518)	[4,924]	{2,462}
Sumner	24,853	24,864	24,940	24,971	25,053	(5,011)	[1,203]	{601}	25,148	(5,030)	[1,207]	{604}	25,256	(5,051)	[1,212]	{606}
Williamson	28,855	28,865	28,933	28,971	29,033	(5,807)	[1,394]	{697}	29,107	(5,821)	[1,397]	{699}	29,193	(5,839)	[1,401]	{701}

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.