

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

Date: 7/19/21

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 7/19/21 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.

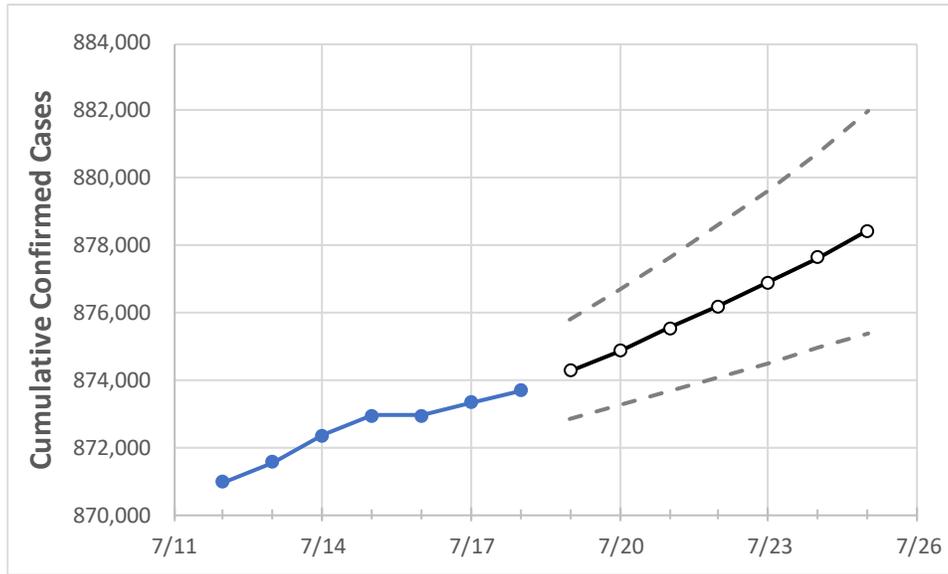
IEM's Modeling Lead

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:						
	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25
Tennessee	872,934	872,945	873,315	873,685	874,261	874,875	875,530	876,207	876,906	877,649	878,425

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:						
	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25
Blount	16,026	16,031	16,037	16,042	16,050	16,058	16,067	16,076	16,085	16,095	16,105
Davidson	90,913	90,936	90,959	90,982	91,035	91,091	91,148	91,209	91,274	91,341	91,411
Hamilton	45,840	45,854	45,868	45,882	45,916	45,953	45,989	46,027	46,066	46,107	46,149
Knox	52,319	52,333	52,347	52,361	52,383	52,406	52,430	52,455	52,482	52,510	52,540
Rutherford	43,915	43,924	43,934	43,943	43,959	43,977	43,994	44,013	44,031	44,051	44,070
Shelby	100,262	100,311	100,360	100,409	100,544	100,682	100,828	100,981	101,137	101,305	101,476
Sumner	24,832	24,843	24,853	24,864	24,888	24,912	24,937	24,962	24,989	25,016	25,044
Williamson	28,834	28,844	28,855	28,865	28,884	28,903	28,923	28,945	28,967	28,991	29,016

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:											
	7/15	7/16	7/17	7/18	7/20			7/22			7/24					
Blount	16,026	16,031	16,037	16,042	16,058	(3,212)	[771]	{385}	16,076	(3,215)	[772]	{386}	16,095	(3,219)	[773]	{386}
Davidson	90,913	90,936	90,959	90,982	91,091	(18,218)	[4,372]	{2,186}	91,209	(18,242)	[4,378]	{2,189}	91,341	(18,268)	[4,384]	{2,192}
Hamilton	45,840	45,854	45,868	45,882	45,953	(9,191)	[2,206]	{1,103}	46,027	(9,205)	[2,209]	{1,105}	46,107	(9,221)	[2,213]	{1,107}
Knox	52,319	52,333	52,347	52,361	52,406	(10,481)	[2,515]	{1,258}	52,455	(10,491)	[2,518]	{1,259}	52,510	(10,502)	[2,521]	{1,260}
Rutherford	43,915	43,924	43,934	43,943	43,977	(8,795)	[2,111]	{1,055}	44,013	(8,803)	[2,113]	{1,056}	44,051	(8,810)	[2,114]	{1,057}
Shelby	100,262	100,311	100,360	100,409	100,682	(20,136)	[4,833]	{2,416}	100,981	(20,196)	[4,847]	{2,424}	101,305	(20,261)	[4,863]	{2,431}
Sumner	24,832	24,843	24,853	24,864	24,912	(4,982)	[1,196]	{598}	24,962	(4,992)	[1,198]	{599}	25,016	(5,003)	[1,201]	{600}
Williamson	28,834	28,844	28,855	28,865	28,903	(5,781)	[1,387]	{694}	28,945	(5,789)	[1,389]	{695}	28,991	(5,798)	[1,392]	{696}

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.