

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

Date: 12/22/21

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 12/22/21 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.

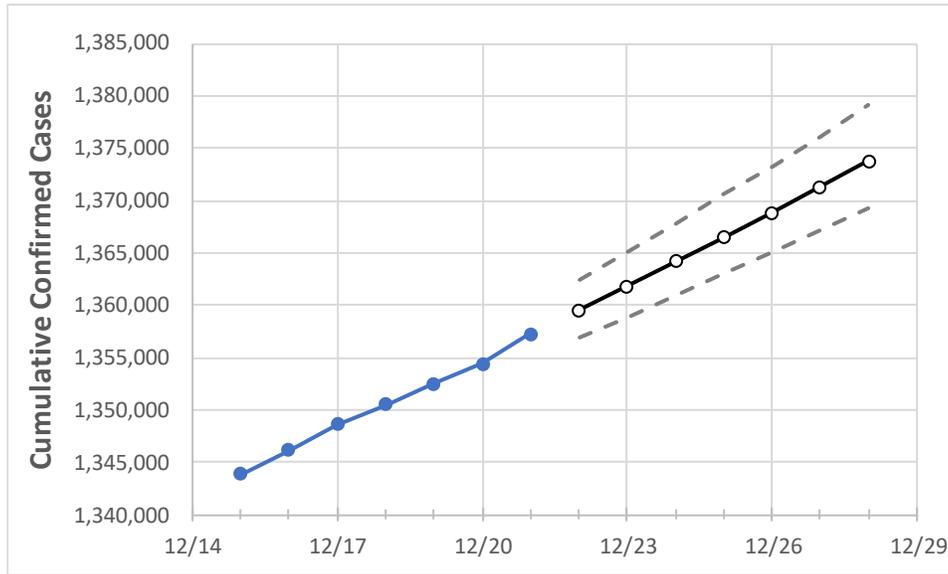
IEM's Modeling Lead

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Tennessee	1,350,546	1,352,456	1,354,367	1,357,289	1,359,542	1,361,835	1,364,140	1,366,490	1,368,858	1,371,347	1,373,787

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Blount	25,192	25,220	25,248	25,295	25,336	25,377	25,419	25,461	25,503	25,545	25,590
Davidson	127,243	127,490	127,738	128,127	128,382	128,645	128,916	129,199	129,483	129,787	130,093
Hamilton	66,925	67,031	67,136	67,251	67,377	67,503	67,631	67,762	67,897	68,036	68,178
Knox	83,000	83,093	83,187	83,291	83,405	83,521	83,635	83,748	83,867	83,983	84,099
Rutherford	65,432	65,527	65,621	65,766	65,866	65,975	66,076	66,184	66,292	66,401	66,513
Shelby	151,407	151,756	152,105	152,588	152,961	153,347	153,743	154,166	154,606	155,051	155,511
Sumner	36,185	36,250	36,316	36,389	36,458	36,528	36,599	36,673	36,747	36,826	36,903
Williamson	42,126	42,191	42,255	42,355	42,425	42,496	42,566	42,639	42,713	42,788	42,864

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:											
	12/18	12/19	12/20	12/21	12/23			12/25			12/27					
Blount	25,192	25,220	25,248	25,295	25,377	(5,075)	[1,218]	{609}	25,461	(5,092)	[1,222]	{611}	25,545	(5,109)	[1,226]	{613}
Davidson	127,243	127,490	127,738	128,127	128,645	(25,729)	[6,175]	{3,087}	129,199	(25,840)	[6,202]	{3,101}	129,787	(25,957)	[6,230]	{3,115}
Hamilton	66,925	67,031	67,136	67,251	67,503	(13,501)	[3,240]	{1,620}	67,762	(13,552)	[3,253]	{1,626}	68,036	(13,607)	[3,266]	{1,633}
Knox	83,000	83,093	83,187	83,291	83,521	(16,704)	[4,009]	{2,004}	83,748	(16,750)	[4,020]	{2,010}	83,983	(16,797)	[4,031]	{2,016}
Rutherford	65,432	65,527	65,621	65,766	65,975	(13,195)	[3,167]	{1,583}	66,184	(13,237)	[3,177]	{1,588}	66,401	(13,280)	[3,187]	{1,594}
Shelby	151,407	151,756	152,105	152,588	153,347	(30,669)	[7,361]	{3,680}	154,166	(30,833)	[7,400]	{3,700}	155,051	(31,010)	[7,442]	{3,721}
Sumner	36,185	36,250	36,316	36,389	36,528	(7,306)	[1,753]	{877}	36,673	(7,335)	[1,760]	{880}	36,826	(7,365)	[1,768]	{884}
Williamson	42,126	42,191	42,255	42,355	42,496	(8,499)	[2,040]	{1,020}	42,639	(8,528)	[2,047]	{1,023}	42,788	(8,558)	[2,054]	{1,027}

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.