

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

Date: 7/23/21

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 7/23/21 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.

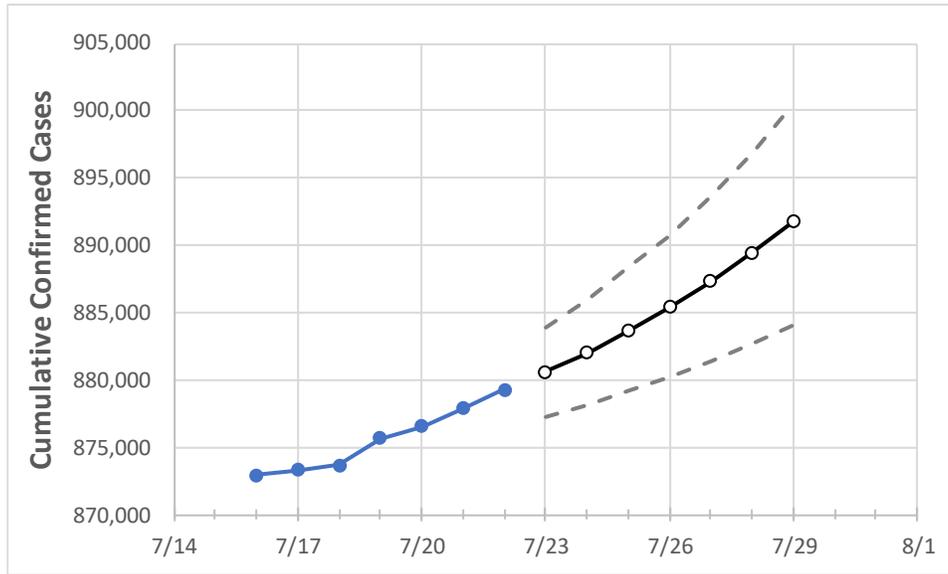
IEM's Modeling Lead

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Tennessee	875,628	876,543	877,850	879,262	880,598	882,041	883,660	885,414	887,335	889,445	891,767

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Blount	16,069	16,079	16,104	16,126	16,141	16,157	16,174	16,192	16,210	16,230	16,251
Davidson	91,136	91,206	91,362	91,500	91,615	91,742	91,879	92,025	92,185	92,356	92,543
Hamilton	45,994	46,037	46,095	46,157	46,218	46,284	46,354	46,428	46,506	46,589	46,679
Knox	52,462	52,512	52,591	52,652	52,718	52,791	52,868	52,953	53,048	53,149	53,260
Rutherford	44,034	44,081	44,154	44,215	44,274	44,339	44,410	44,489	44,574	44,667	44,772
Shelby	100,878	101,038	101,264	101,496	101,746	102,012	102,301	102,607	102,942	103,305	103,686
Sumner	24,940	24,971	25,015	25,054	25,098	25,145	25,196	25,251	25,309	25,370	25,437
Williamson	28,933	28,971	29,014	29,078	29,122	29,170	29,225	29,285	29,350	29,421	29,500

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:											
	7/19	7/20	7/21	7/22	7/24			7/26			7/28					
Blount	16,069	16,079	16,104	16,126	16,157	(3,231)	[776]	{388}	16,192	(3,238)	[777]	{389}	16,230	(3,246)	[779]	{390}
Davidson	91,136	91,206	91,362	91,500	91,742	(18,348)	[4,404]	{2,202}	92,025	(18,405)	[4,417]	{2,209}	92,356	(18,471)	[4,433]	{2,217}
Hamilton	45,994	46,037	46,095	46,157	46,284	(9,257)	[2,222]	{1,111}	46,428	(9,286)	[2,229]	{1,114}	46,589	(9,318)	[2,236]	{1,118}
Knox	52,462	52,512	52,591	52,652	52,791	(10,558)	[2,534]	{1,267}	52,953	(10,591)	[2,542]	{1,271}	53,149	(10,630)	[2,551]	{1,276}
Rutherford	44,034	44,081	44,154	44,215	44,339	(8,868)	[2,128]	{1,064}	44,489	(8,898)	[2,135]	{1,068}	44,667	(8,933)	[2,144]	{1,072}
Shelby	100,878	101,038	101,264	101,496	102,012	(20,402)	[4,897]	{2,448}	102,607	(20,521)	[4,925]	{2,463}	103,305	(20,661)	[4,959]	{2,479}
Sumner	24,940	24,971	25,015	25,054	25,145	(5,029)	[1,207]	{603}	25,251	(5,050)	[1,212]	{606}	25,370	(5,074)	[1,218]	{609}
Williamson	28,933	28,971	29,014	29,078	29,170	(5,834)	[1,400]	{700}	29,285	(5,857)	[1,406]	{703}	29,421	(5,884)	[1,412]	{706}

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.