

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/22/21**

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 10/22/21 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.

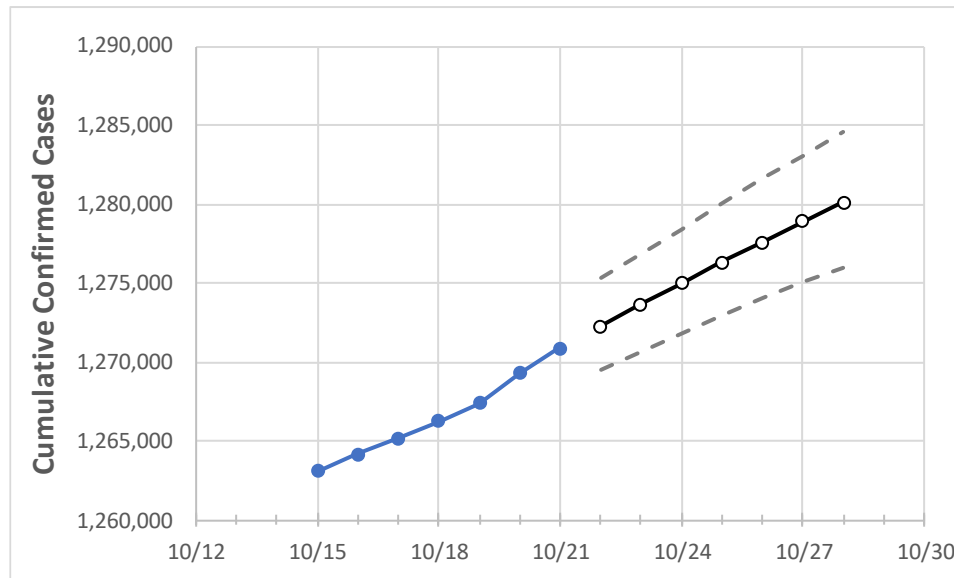
IEM's Modeling Lead

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:							
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	
Tennessee	1,266,252	1,267,363	1,269,289	1,270,876	1,272,280	1,273,664	1,274,988	1,276,321	1,277,602	1,278,877	1,280,085	

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:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Blount	23,491	23,518	23,542	23,571	23,599	23,625	23,649	23,673	23,696	23,722	23,742
Davidson	120,131	120,257	120,351	120,472	120,596	120,712	120,827	120,946	121,054	121,162	121,266
Hamilton	62,920	63,005	63,120	63,208	63,291	63,375	63,452	63,531	63,612	63,693	63,768
Knox	77,662	77,772	77,902	78,054	78,174	78,291	78,413	78,521	78,633	78,749	78,853
Rutherford	61,245	61,297	61,367	61,447	61,509	61,568	61,631	61,689	61,747	61,804	61,855
Shelby	143,276	143,376	143,490	143,620	143,730	143,839	143,944	144,045	144,143	144,242	144,340
Sumner	33,940	33,979	34,034	34,051	34,088	34,125	34,160	34,194	34,229	34,265	34,299
Williamson	39,295	39,334	39,395	39,443	39,485	39,527	39,570	39,610	39,650	39,690	39,729

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:											
	10/18	10/19	10/20	10/21	10/23				10/25				10/27			
Blount	23,491	23,518	23,542	23,571	23,625	(4,725)	[1,134]	{567}	23,673	(4,735)	[1,136]	{568}	23,722	(4,744)	[1,139]	{569}
Davidson	120,131	120,257	120,351	120,472	120,712	(24,142)	[5,794]	{2,897}	120,946	(24,189)	[5,805]	{2,903}	121,162	(24,232)	[5,816]	{2,908}
Hamilton	62,920	63,005	63,120	63,208	63,375	(12,675)	[3,042]	{1,521}	63,531	(12,706)	[3,049]	{1,525}	63,693	(12,739)	[3,057]	{1,529}
Knox	77,662	77,772	77,902	78,054	78,291	(15,658)	[3,758]	{1,879}	78,521	(15,704)	[3,769]	{1,884}	78,749	(15,750)	[3,780]	{1,890}
Rutherford	61,245	61,297	61,367	61,447	61,568	(12,314)	[2,955]	{1,478}	61,689	(12,338)	[2,961]	{1,481}	61,804	(12,361)	[2,967]	{1,483}
Shelby	143,276	143,376	143,490	143,620	143,839	(28,768)	[6,904]	{3,452}	144,045	(28,809)	[6,914]	{3,457}	144,242	(28,848)	[6,924]	{3,462}
Sumner	33,940	33,979	34,034	34,051	34,125	(6,825)	[1,638]	{819}	34,194	(6,839)	[1,641]	{821}	34,265	(6,853)	[1,645]	{822}
Williamson	39,295	39,334	39,395	39,443	39,527	(7,905)	[1,897]	{949}	39,610	(7,922)	[1,901]	{951}	39,690	(7,938)	[1,905]	{953}

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.