

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/15/21**

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 12/15/21 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.

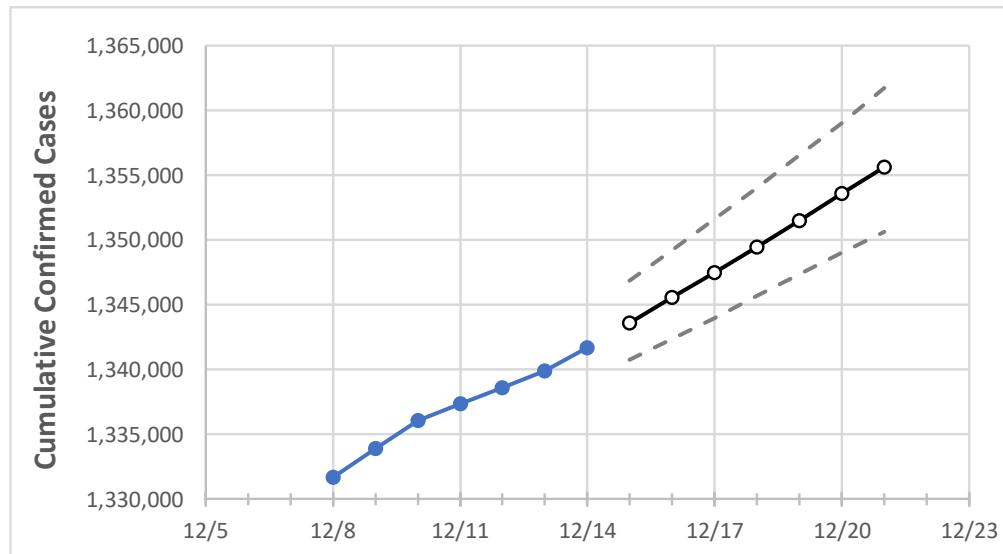
IEM's Modeling Lead

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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Tennessee	1,337,343	1,338,607	1,339,872	1,341,702	1,343,594	1,345,574	1,347,500	1,349,475	1,351,492	1,353,569	1,355,583

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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Blount	24,919	24,944	24,968	25,005	25,043	25,080	25,117	25,155	25,193	25,232	25,269
Davidson	125,937	126,035	126,132	126,245	126,397	126,555	126,707	126,866	127,023	127,192	127,359
Hamilton	66,182	66,254	66,325	66,435	66,539	66,646	66,752	66,864	66,979	67,095	67,215
Knox	82,258	82,326	82,393	82,502	82,620	82,737	82,857	82,977	83,097	83,221	83,342
Rutherford	64,826	64,885	64,943	65,006	65,091	65,175	65,260	65,345	65,432	65,518	65,607
Shelby	149,724	149,861	149,998	150,149	150,342	150,538	150,737	150,942	151,150	151,366	151,588
Sumner	35,781	35,814	35,847	35,896	35,945	35,995	36,045	36,099	36,150	36,204	36,259
Williamson	41,722	41,766	41,809	41,871	41,937	42,005	42,072	42,139	42,207	42,276	42,344

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:											
	12/11	12/12	12/13	12/14	12/16				12/18				12/20			
Blount	24,919	24,944	24,968	25,005	25,080	(5,016)	[1,204]	{602}	25,155	(5,031)	[1,207]	{604}	25,232	(5,046)	[1,211]	{606}
Davidson	125,937	126,035	126,132	126,245	126,555	(25,311)	[6,075]	{3,037}	126,866	(25,373)	[6,090]	{3,045}	127,192	(25,438)	[6,105]	{3,053}
Hamilton	66,182	66,254	66,325	66,435	66,646	(13,329)	[3,199]	{1,599}	66,864	(13,373)	[3,209]	{1,605}	67,095	(13,419)	[3,221]	{1,610}
Knox	82,258	82,326	82,393	82,502	82,737	(16,547)	[3,971]	{1,986}	82,977	(16,595)	[3,983]	{1,991}	83,221	(16,644)	[3,995]	{1,997}
Rutherford	64,826	64,885	64,943	65,006	65,175	(13,035)	[3,128]	{1,564}	65,345	(13,069)	[3,137]	{1,568}	65,518	(13,104)	[3,145]	{1,572}
Shelby	149,724	149,861	149,998	150,149	150,538	(30,108)	[7,226]	{3,613}	150,942	(30,188)	[7,245]	{3,623}	151,366	(30,273)	[7,266]	{3,633}
Sumner	35,781	35,814	35,847	35,896	35,995	(7,199)	[1,728]	{864}	36,099	(7,220)	[1,733]	{866}	36,204	(7,241)	[1,738]	{869}
Williamson	41,722	41,766	41,809	41,871	42,005	(8,401)	[2,016]	{1,008}	42,139	(8,428)	[2,023]	{1,011}	42,276	(8,455)	[2,029]	{1,015}

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.