

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

Date: 12/10/21

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 12/10/21 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.

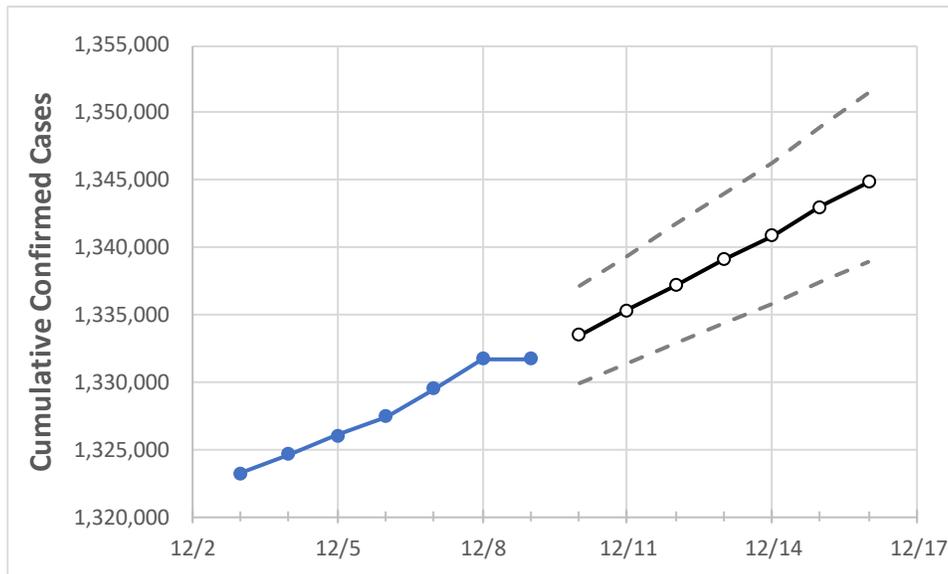
IEM's Modeling Lead

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Tennessee	1,327,453	1,329,496	1,331,703	1,331,703	1,333,467	1,335,332	1,337,169	1,339,080	1,340,910	1,343,012	1,344,894

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Blount	24,728	24,756	24,807	24,807	24,847	24,887	24,927	24,970	25,012	25,055	25,099
Davidson	125,217	125,343	125,534	125,534	125,680	125,827	125,974	126,128	126,284	126,441	126,603
Hamilton	65,662	65,770	65,859	65,859	65,938	66,015	66,095	66,175	66,260	66,344	66,429
Knox	81,633	81,776	81,902	81,902	82,028	82,152	82,280	82,411	82,545	82,683	82,820
Rutherford	64,361	64,445	64,538	64,538	64,624	64,711	64,799	64,887	64,977	65,068	65,159
Shelby	148,778	148,920	149,123	149,123	149,283	149,447	149,614	149,785	149,961	150,137	150,308
Sumner	35,537	35,580	35,649	35,649	35,702	35,756	35,811	35,867	35,925	35,986	36,045
Williamson	41,377	41,448	41,530	41,530	41,595	41,663	41,729	41,796	41,868	41,939	42,010

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:											
	12/6	12/7	12/8	12/9	12/11			12/13			12/15					
Blount	24,728	24,756	24,807	24,807	24,887	(4,977)	[1,195]	{597}	24,970	(4,994)	[1,199]	{599}	25,055	(5,011)	[1,203]	{601}
Davidson	125,217	125,343	125,534	125,534	125,827	(25,165)	[6,040]	{3,020}	126,128	(25,226)	[6,054]	{3,027}	126,441	(25,288)	[6,069]	{3,035}
Hamilton	65,662	65,770	65,859	65,859	66,015	(13,203)	[3,169]	{1,584}	66,175	(13,235)	[3,176]	{1,588}	66,344	(13,269)	[3,185]	{1,592}
Knox	81,633	81,776	81,902	81,902	82,152	(16,430)	[3,943]	{1,972}	82,411	(16,482)	[3,956]	{1,978}	82,683	(16,537)	[3,969]	{1,984}
Rutherford	64,361	64,445	64,538	64,538	64,711	(12,942)	[3,106]	{1,553}	64,887	(12,977)	[3,115]	{1,557}	65,068	(13,014)	[3,123]	{1,562}
Shelby	148,778	148,920	149,123	149,123	149,447	(29,889)	[7,173]	{3,587}	149,785	(29,957)	[7,190]	{3,595}	150,137	(30,027)	[7,207]	{3,603}
Sumner	35,537	35,580	35,649	35,649	35,756	(7,151)	[1,716]	{858}	35,867	(7,173)	[1,722]	{861}	35,986	(7,197)	[1,727]	{864}
Williamson	41,377	41,448	41,530	41,530	41,663	(8,333)	[2,000]	{1,000}	41,796	(8,359)	[2,006]	{1,003}	41,939	(8,388)	[2,013]	{1,007}

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.