

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

Date: 11/15/21

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 11/15/21 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.

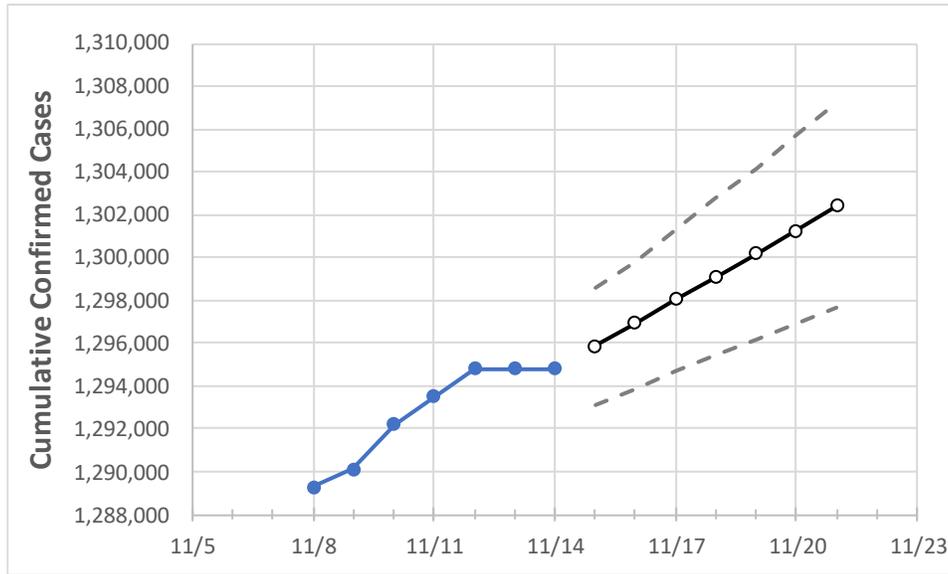
IEM's Modeling Lead

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:						
	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21
Tennessee	1,293,498	1,294,801	1,294,801	1,294,801	1,295,882	1,296,955	1,298,037	1,299,099	1,300,201	1,301,283	1,302,398

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:						
	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21
Blount	24,009	24,030	24,030	24,030	24,051	24,071	24,092	24,113	24,134	24,154	24,175
Davidson	122,406	122,525	122,525	122,525	122,621	122,716	122,812	122,909	123,002	123,096	123,196
Hamilton	64,237	64,292	64,292	64,292	64,336	64,380	64,423	64,466	64,509	64,553	64,596
Knox	79,511	79,582	79,582	79,582	79,642	79,701	79,759	79,818	79,874	79,933	79,990
Rutherford	62,594	62,647	62,647	62,647	62,699	62,752	62,804	62,856	62,909	62,961	63,013
Shelby	145,633	145,771	145,771	145,771	145,892	146,014	146,137	146,261	146,397	146,528	146,663
Sumner	34,639	34,671	34,671	34,671	34,701	34,731	34,763	34,792	34,824	34,855	34,886
Williamson	40,103	40,138	40,138	40,138	40,172	40,205	40,238	40,272	40,305	40,340	40,375

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:											
	11/11	11/12	11/13	11/14	11/16			11/18			11/20					
Blount	24,009	24,030	24,030	24,030	24,071	(4,814)	[1,155]	{578}	24,113	(4,823)	[1,157]	{579}	24,154	(4,831)	[1,159]	{580}
Davidson	122,406	122,525	122,525	122,525	122,716	(24,543)	[5,890]	{2,945}	122,909	(24,582)	[5,900]	{2,950}	123,096	(24,619)	[5,909]	{2,954}
Hamilton	64,237	64,292	64,292	64,292	64,380	(12,876)	[3,090]	{1,545}	64,466	(12,893)	[3,094]	{1,547}	64,553	(12,911)	[3,099]	{1,549}
Knox	79,511	79,582	79,582	79,582	79,701	(15,940)	[3,826]	{1,913}	79,818	(15,964)	[3,831]	{1,916}	79,933	(15,987)	[3,837]	{1,918}
Rutherford	62,594	62,647	62,647	62,647	62,752	(12,550)	[3,012]	{1,506}	62,856	(12,571)	[3,017]	{1,509}	62,961	(12,592)	[3,022]	{1,511}
Shelby	145,633	145,771	145,771	145,771	146,014	(29,203)	[7,009]	{3,504}	146,261	(29,252)	[7,021]	{3,510}	146,528	(29,306)	[7,033]	{3,517}
Sumner	34,639	34,671	34,671	34,671	34,731	(6,946)	[1,667]	{834}	34,792	(6,958)	[1,670]	{835}	34,855	(6,971)	[1,673]	{837}
Williamson	40,103	40,138	40,138	40,138	40,205	(8,041)	[1,930]	{965}	40,272	(8,054)	[1,933]	{967}	40,340	(8,068)	[1,936]	{968}

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.