

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

Date: 2/25/22

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 2/25/22 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.

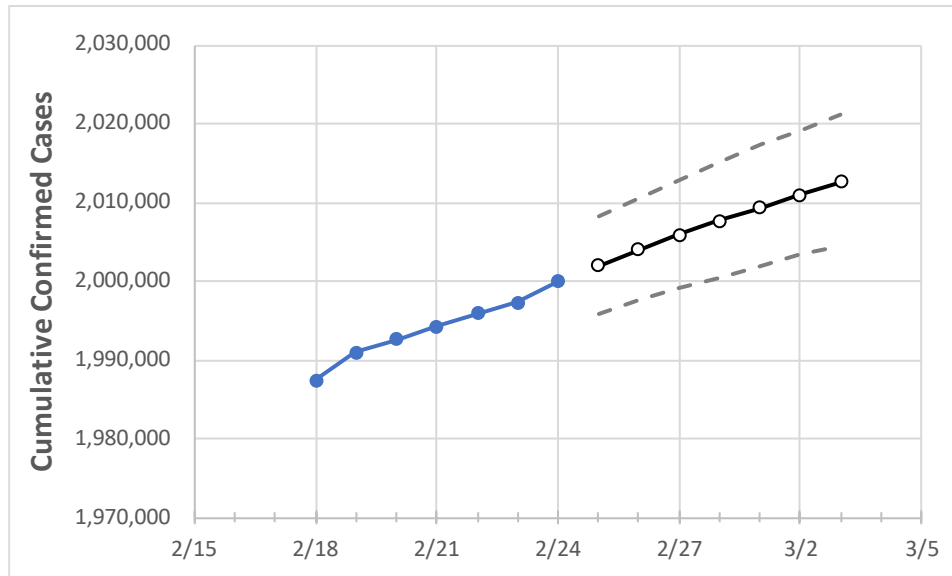
IEM's Modeling Lead

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3

Tennessee 1,994,272 1,995,901 1,997,326 1,999,965 2,002,033 2,004,045 2,005,918 2,007,695 2,009,336 2,010,944 2,012,615

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Blount	38,565	38,609	38,653	38,653	38,692	38,728	38,762	38,793	38,822	38,852	38,878
Davidson	187,958	188,162	188,366	188,366	188,540	188,704	188,857	189,004	189,143	189,279	189,399
Hamilton	97,074	97,258	97,442	97,442	97,621	97,798	97,973	98,146	98,318	98,484	98,645
Knox	125,254	125,463	125,673	125,673	125,848	126,018	126,174	126,325	126,461	126,596	126,721
Rutherford	94,524	94,630	94,737	94,737	94,819	94,903	94,979	95,051	95,121	95,183	95,244
Shelby	232,694	232,925	233,156	233,156	233,348	233,534	233,709	233,880	234,045	234,204	234,351
Sumner	52,493	52,558	52,623	52,623	52,675	52,726	52,774	52,821	52,862	52,905	52,942
Williamson	61,206	61,271	61,337	61,337	61,397	61,451	61,501	61,548	61,597	61,640	61,681

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:											
	2/21	2/22	2/23	2/24	2/26				2/28				3/2			
Blount	38,565	38,609	38,653	38,653	38,728	(7,746)	[1,859]	{929}	38,793	(7,759)	[1,862]	{931}	38,852	(7,770)	[1,865]	{932}
Davidson	187,958	188,162	188,366	188,366	188,704	(37,741)	[9,058]	{4,529}	189,004	(37,801)	[9,072]	{4,536}	189,279	(37,856)	[9,085]	{4,543}
Hamilton	97,074	97,258	97,442	97,442	97,798	(19,560)	[4,694]	{2,347}	98,146	(19,629)	[4,711]	{2,356}	98,484	(19,697)	[4,727]	{2,364}
Knox	125,254	125,463	125,673	125,673	126,018	(25,204)	[6,049]	{3,024}	126,325	(25,265)	[6,064]	{3,032}	126,596	(25,319)	[6,077]	{3,038}
Rutherford	94,524	94,630	94,737	94,737	94,903	(18,981)	[4,555]	{2,278}	95,051	(19,010)	[4,562]	{2,281}	95,183	(19,037)	[4,569]	{2,284}
Shelby	232,694	232,925	233,156	233,156	233,534	(46,707)	[11,210]	{5,605}	233,880	(46,776)	[11,226]	{5,613}	234,204	(46,841)	[11,242]	{5,621}
Sumner	52,493	52,558	52,623	52,623	52,726	(10,545)	[2,531]	{1,265}	52,821	(10,564)	[2,535]	{1,268}	52,905	(10,581)	[2,539]	{1,270}
Williamson	61,206	61,271	61,337	61,337	61,451	(12,290)	[2,950]	{1,475}	61,548	(12,310)	[2,954]	{1,477}	61,640	(12,328)	[2,959]	{1,479}

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.