

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 9/22/21**

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 9/22/21 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.

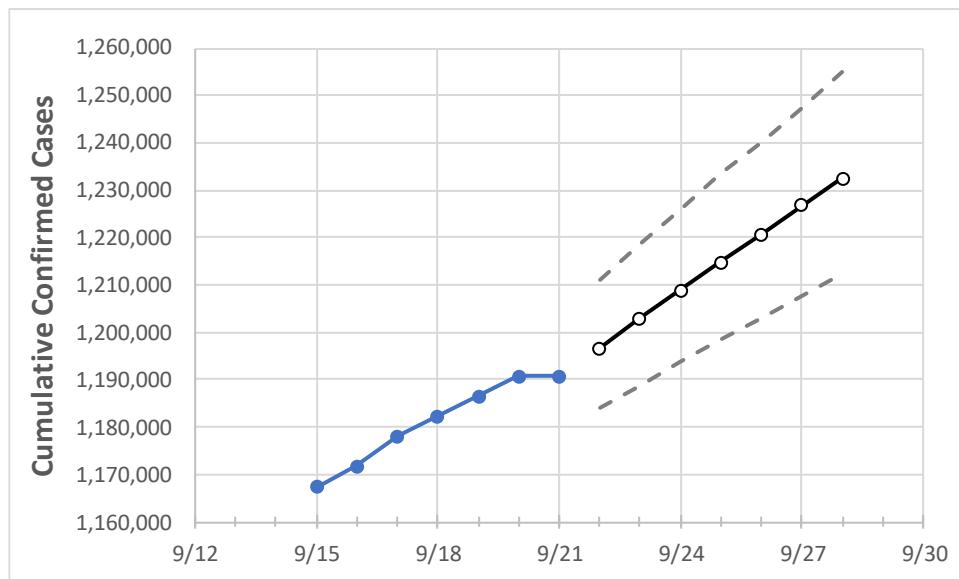
IEM's Modeling Lead

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:								
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28		
Tennessee	1,182,342	1,186,515	1,190,689	1,190,689	1,196,715	1,203,041	1,208,816	1,214,783	1,220,744	1,226,765	1,232,540		

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:								
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28		
Blount	21,575	21,669	21,762	21,762	21,909	22,055	22,201	22,345	22,501	22,650	22,801		
Davidson	113,252	113,564	113,876	113,876	114,344	114,799	115,259	115,705	116,149	116,607	117,066		
Hamilton	59,231	59,377	59,524	59,524	59,768	60,007	60,252	60,483	60,714	60,950	61,182		
Knox	71,366	71,681	71,997	71,997	72,513	73,014	73,520	74,017	74,541	75,042	75,526		
Rutherford	57,911	58,142	58,372	58,372	58,670	58,967	59,247	59,539	59,837	60,114	60,418		
Shelby	136,274	136,646	137,018	137,018	137,537	138,038	138,573	139,051	139,596	140,095	140,590		
Sumner	32,256	32,327	32,399	32,399	32,513	32,623	32,731	32,841	32,940	33,050	33,156		
Williamson	37,178	37,275	37,372	37,372	37,523	37,671	37,817	37,965	38,107	38,254	38,396		

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:			
	9/18	9/19	9/20	9/21	9/23	9/25	9/27	
Blount	21,575	21,669	21,762	21,762	22,055 (4,411) [1,059] {529}	22,345 (4,469) [1,073] {536}	22,650 (4,530) [1,087] {544}	
Davidson	113,252	113,564	113,876	113,876	114,799 (22,960) [5,510] {2,755}	115,705 (23,141) [5,554] {2,777}	116,607 (23,321) [5,597] {2,799}	
Hamilton	59,231	59,377	59,524	59,524	60,007 (12,001) [2,880] {1,440}	60,483 (12,097) [2,903] {1,452}	60,950 (12,190) [2,926] {1,463}	
Knox	71,366	71,681	71,997	71,997	73,014 (14,603) [3,505] {1,752}	74,017 (14,803) [3,553] {1,776}	75,042 (15,008) [3,602] {1,801}	
Rutherford	57,911	58,142	58,372	58,372	58,967 (11,793) [2,830] {1,415}	59,539 (11,908) [2,858] {1,429}	60,114 (12,023) [2,885] {1,443}	
Shelby	136,274	136,646	137,018	137,018	138,038 (27,608) [6,626] {3,313}	139,051 (27,810) [6,674] {3,337}	140,095 (28,019) [6,725] {3,362}	
Sumner	32,256	32,327	32,399	32,399	32,623 (6,525) [1,566] {783}	32,841 (6,568) [1,576] {788}	33,050 (6,610) [1,586] {793}	
Williamson	37,178	37,275	37,372	37,372	37,671 (7,534) [1,808] {904}	37,965 (7,593) [1,822] {911}	38,254 (7,651) [1,836] {918}	

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.