

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

Date: 2/12/21

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 2/12/21 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.

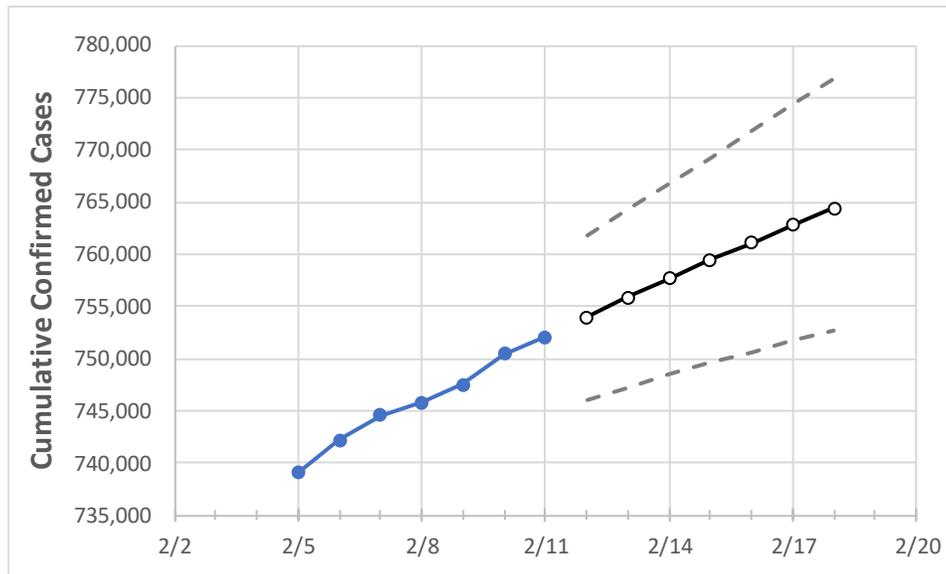
IEM's Modeling Lead

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:							
	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	
Tennessee	745,826	747,462	750,409	752,033	753,934	755,835	757,674	759,441	761,124	762,799	764,408	

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:							
	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	
Blount	13,016	13,074	13,212	13,509	13,604	13,701	13,803	13,912	14,025	14,146	14,267	
Davidson	76,578	76,662	77,018	77,770	77,975	78,176	78,371	78,571	78,775	78,975	79,172	
Hamilton	38,259	38,354	38,421	38,584	38,703	38,818	38,928	39,037	39,139	39,244	39,340	
Knox	42,824	42,916	43,033	43,304	43,454	43,599	43,741	43,885	44,023	44,161	44,299	
Rutherford	36,036	36,115	36,273	36,557	36,674	36,790	36,906	37,017	37,128	37,239	37,351	
Shelby	82,975	83,147	83,324	83,959	84,206	84,452	84,697	84,936	85,164	85,387	85,615	
Sumner	19,852	19,892	19,975	20,234	20,322	20,411	20,499	20,589	20,678	20,770	20,862	
Williamson	23,824	23,860	23,934	24,084	24,176	24,267	24,359	24,449	24,538	24,626	24,716	

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:											
	2/8	2/9	2/10	2/11	2/13				2/15				2/17			
Blount	13,016	13,074	13,212	13,509	13,701	(2,740)	[658]	{329}	13,912	(2,782)	[668]	{334}	14,146	(2,829)	[679]	{339}
Davidson	76,578	76,662	77,018	77,770	78,176	(15,635)	[3,752]	{1,876}	78,571	(15,714)	[3,771]	{1,886}	78,975	(15,795)	[3,791]	{1,895}
Hamilton	38,259	38,354	38,421	38,584	38,818	(7,764)	[1,863]	{932}	39,037	(7,807)	[1,874]	{937}	39,244	(7,849)	[1,884]	{942}
Knox	42,824	42,916	43,033	43,304	43,599	(8,720)	[2,093]	{1,046}	43,885	(8,777)	[2,106]	{1,053}	44,161	(8,832)	[2,120]	{1,060}
Rutherford	36,036	36,115	36,273	36,557	36,790	(7,358)	[1,766]	{883}	37,017	(7,403)	[1,777]	{888}	37,239	(7,448)	[1,787]	{894}
Shelby	82,975	83,147	83,324	83,959	84,452	(16,890)	[4,054]	{2,027}	84,936	(16,987)	[4,077]	{2,038}	85,387	(17,077)	[4,099]	{2,049}
Sumner	19,852	19,892	19,975	20,234	20,411	(4,082)	[980]	{490}	20,589	(4,118)	[988]	{494}	20,770	(4,154)	[997]	{498}
Williamson	23,824	23,860	23,934	24,084	24,267	(4,853)	[1,165]	{582}	24,449	(4,890)	[1,174]	{587}	24,626	(4,925)	[1,182]	{591}

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.