

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

Date: 1/7/22

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 1/7/22 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.

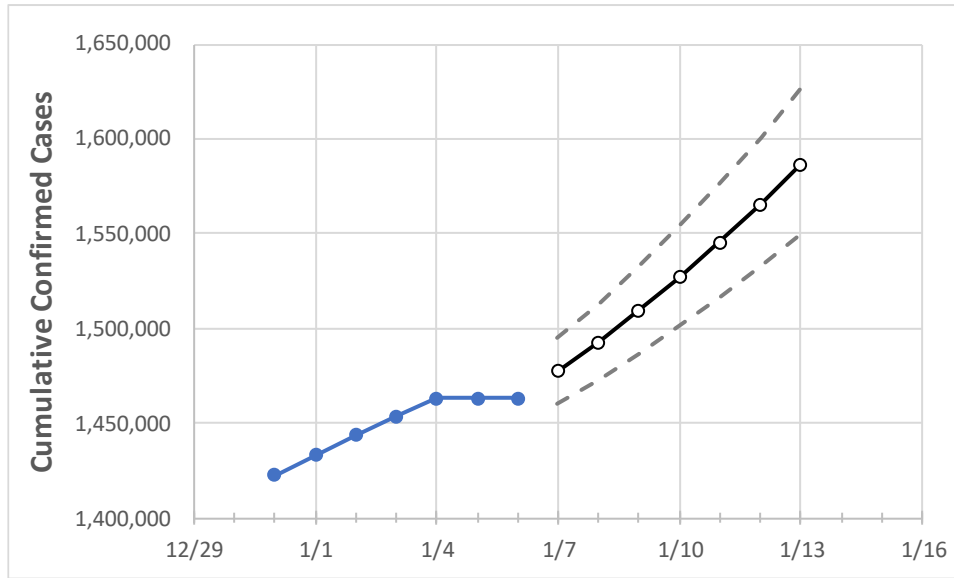
IEM's Modeling Lead

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:							
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	

Tennessee 1,453,766 1,462,996 1,462,996 1,462,996 1,477,526 1,492,864 1,509,602 1,526,809 1,545,431 1,565,673 1,586,501

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:							
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	
Blount	26,253	26,337	26,337	26,337	26,461	26,588	26,717	26,858	27,003	27,158	27,315	
Davidson	142,248	143,158	143,158	143,158	145,308	147,610	150,039	152,644	155,422	158,406	161,579	
Hamilton	71,789	72,342	72,342	72,342	73,045	73,775	74,553	75,408	76,291	77,239	78,246	
Knox	87,277	87,981	87,981	87,981	88,664	89,385	90,161	90,983	91,856	92,816	93,814	
Rutherford	70,378	70,719	70,719	70,719	71,444	72,213	73,024	73,893	74,838	75,826	76,872	
Shelby	176,310	178,126	178,126	178,126	181,898	185,939	190,215	194,892	199,796	205,181	210,823	
Sumner	39,307	39,506	39,506	39,506	39,944	40,415	40,892	41,430	41,975	42,575	43,214	
Williamson	46,063	46,356	46,356	46,356	46,885	47,459	48,052	48,699	49,381	50,103	50,877	

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:											
	1/3	1/4	1/5	1/6	1/8			1/10			1/12					
Blount	26,253	26,337	26,337	26,337	26,588	(5,318)	[1,276]	{638}	26,858	(5,372)	[1,289]	{645}	27,158	(5,432)	[1,304]	{652}
Davidson	142,248	143,158	143,158	143,158	147,610	(29,522)	[7,085]	{3,543}	152,644	(30,529)	[7,327]	{3,663}	158,406	(31,681)	[7,604]	{3,802}
Hamilton	71,789	72,342	72,342	72,342	73,775	(14,755)	[3,541]	{1,771}	75,408	(15,082)	[3,620]	{1,810}	77,239	(15,448)	[3,707]	{1,854}
Knox	87,277	87,981	87,981	87,981	89,385	(17,877)	[4,291]	{2,145}	90,983	(18,197)	[4,367]	{2,184}	92,816	(18,563)	[4,455]	{2,228}
Rutherford	70,378	70,719	70,719	70,719	72,213	(14,443)	[3,466]	{1,733}	73,893	(14,779)	[3,547]	{1,773}	75,826	(15,165)	[3,640]	{1,820}
Shelby	176,310	178,126	178,126	178,126	185,939	(37,188)	[8,925]	{4,463}	194,892	(38,978)	[9,355]	{4,677}	205,181	(41,036)	[9,849]	{4,924}
Sumner	39,307	39,506	39,506	39,506	40,415	(8,083)	[1,940]	{970}	41,430	(8,286)	[1,989]	{994}	42,575	(8,515)	[2,044]	{1,022}
Williamson	46,063	46,356	46,356	46,356	47,459	(9,492)	[2,278]	{1,139}	48,699	(9,740)	[2,338]	{1,169}	50,103	(10,021)	[2,405]	{1,202}

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.