

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

Date: 2/10/21

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 2/10/21 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.

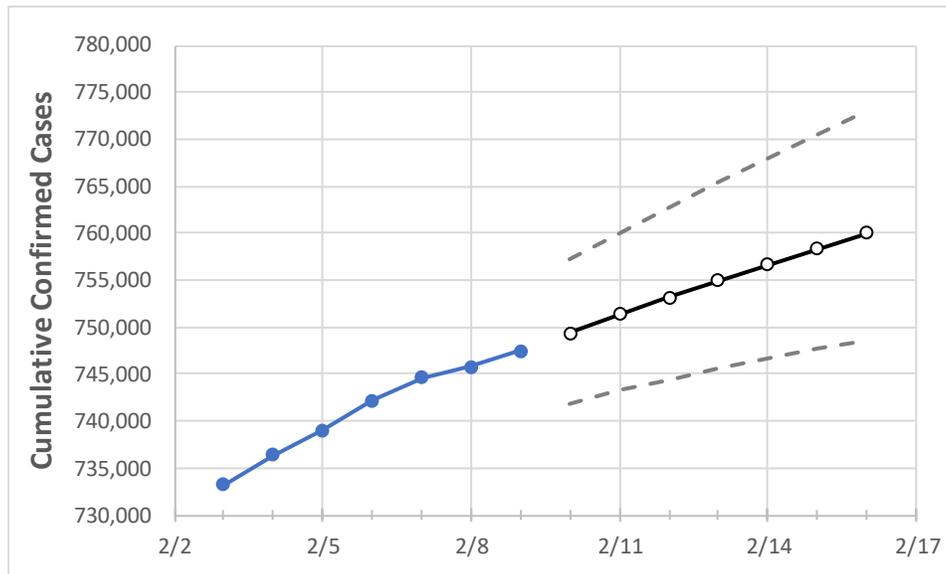
IEM's Modeling Lead

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:							
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	
Tennessee	742,213	744,600	745,826	747,462	749,404	751,361	753,184	754,970	756,704	758,353	760,002	

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:							
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	
Blount	12,922	12,972	13,016	13,074	13,114	13,154	13,194	13,234	13,273	13,312	13,350	
Davidson	76,235	76,465	76,578	76,662	76,832	76,990	77,147	77,296	77,441	77,577	77,710	
Hamilton	38,050	38,169	38,259	38,354	38,484	38,609	38,733	38,854	38,973	39,086	39,195	
Knox	42,459	42,711	42,824	42,916	43,063	43,204	43,346	43,481	43,618	43,752	43,882	
Rutherford	35,838	35,950	36,036	36,115	36,221	36,323	36,421	36,516	36,609	36,698	36,787	
Shelby	82,577	82,845	82,975	83,147	83,368	83,584	83,799	84,004	84,200	84,392	84,582	
Sumner	19,736	19,803	19,852	19,892	19,951	20,010	20,068	20,126	20,183	20,237	20,290	
Williamson	23,627	23,767	23,824	23,860	23,950	24,040	24,127	24,213	24,300	24,381	24,463	

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:											
	2/6	2/7	2/8	2/9	2/11				2/13				2/15			
Blount	12,922	12,972	13,016	13,074	13,154	(2,631)	[631]	{316}	13,234	(2,647)	[635]	{318}	13,312	(2,662)	[639]	{319}
Davidson	76,235	76,465	76,578	76,662	76,990	(15,398)	[3,696]	{1,848}	77,296	(15,459)	[3,710]	{1,855}	77,577	(15,515)	[3,724]	{1,862}
Hamilton	38,050	38,169	38,259	38,354	38,609	(7,722)	[1,853]	{927}	38,854	(7,771)	[1,865]	{933}	39,086	(7,817)	[1,876]	{938}
Knox	42,459	42,711	42,824	42,916	43,204	(8,641)	[2,074]	{1,037}	43,481	(8,696)	[2,087]	{1,044}	43,752	(8,750)	[2,100]	{1,050}
Rutherford	35,838	35,950	36,036	36,115	36,323	(7,265)	[1,743]	{872}	36,516	(7,303)	[1,753]	{876}	36,698	(7,340)	[1,762]	{881}
Shelby	82,577	82,845	82,975	83,147	83,584	(16,717)	[4,012]	{2,006}	84,004	(16,801)	[4,032]	{2,016}	84,392	(16,878)	[4,051]	{2,025}
Sumner	19,736	19,803	19,852	19,892	20,010	(4,002)	[960]	{480}	20,126	(4,025)	[966]	{483}	20,237	(4,047)	[971]	{486}
Williamson	23,627	23,767	23,824	23,860	24,040	(4,808)	[1,154]	{577}	24,213	(4,843)	[1,162]	{581}	24,381	(4,876)	[1,170]	{585}

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.