

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

Date: 7/2/21

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 7/2/21 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.

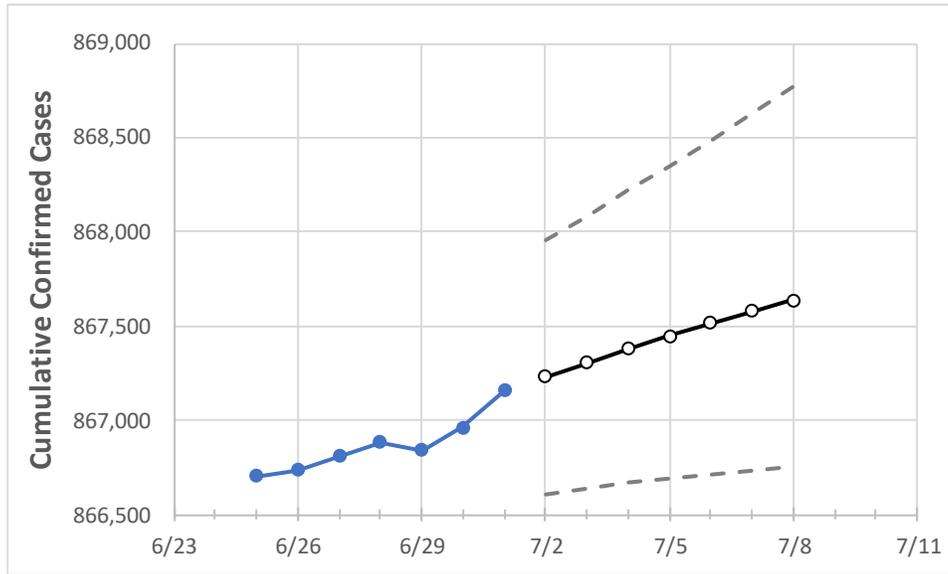
IEM's Modeling Lead

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:							
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8	
Tennessee	866,883	866,841	866,964	867,157	867,234	867,307	867,377	867,446	867,515	867,577	867,639	

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:							
	6/28	6/29	6/30	7/1	7/2	7/3	7/4	7/5	7/6	7/7	7/8	
Blount	15,923	15,922	15,937	15,948	15,953	15,958	15,963	15,967	15,972	15,977	15,982	
Davidson	90,426	90,381	90,374	90,363	90,368	90,373	90,377	90,382	90,387	90,391	90,395	
Hamilton	45,411	45,412	45,439	45,446	45,453	45,459	45,465	45,472	45,478	45,483	45,489	
Knox	52,126	52,131	52,139	52,157	52,166	52,174	52,182	52,190	52,197	52,204	52,210	
Rutherford	43,718	43,717	43,725	43,717	43,719	43,720	43,721	43,723	43,724	43,725	43,726	
Shelby	98,619	98,617	98,684	98,730	98,758	98,786	98,814	98,841	98,868	98,895	98,922	
Sumner	24,518	24,521	24,527	24,536	24,539	24,542	24,545	24,548	24,551	24,553	24,556	
Williamson	28,637	28,640	28,652	28,659	28,662	28,666	28,669	28,673	28,676	28,680	28,683	

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:											
	6/28	6/29	6/30	7/1	7/3			7/5			7/7					
Blount	15,923	15,922	15,937	15,948	15,958	(3,192)	[766]	{383}	15,967	(3,193)	[766]	{383}	15,977	(3,195)	[767]	{383}
Davidson	90,426	90,381	90,374	90,363	90,373	(18,075)	[4,338]	{2,169}	90,382	(18,076)	[4,338]	{2,169}	90,391	(18,078)	[4,339]	{2,169}
Hamilton	45,411	45,412	45,439	45,446	45,459	(9,092)	[2,182]	{1,091}	45,472	(9,094)	[2,183]	{1,091}	45,483	(9,097)	[2,183]	{1,092}
Knox	52,126	52,131	52,139	52,157	52,174	(10,435)	[2,504]	{1,252}	52,190	(10,438)	[2,505]	{1,253}	52,204	(10,441)	[2,506]	{1,253}
Rutherford	43,718	43,717	43,725	43,717	43,720	(8,744)	[2,099]	{1,049}	43,723	(8,745)	[2,099]	{1,049}	43,725	(8,745)	[2,099]	{1,049}
Shelby	98,619	98,617	98,684	98,730	98,786	(19,757)	[4,742]	{2,371}	98,841	(19,768)	[4,744]	{2,372}	98,895	(19,779)	[4,747]	{2,373}
Sumner	24,518	24,521	24,527	24,536	24,542	(4,908)	[1,178]	{589}	24,548	(4,910)	[1,178]	{589}	24,553	(4,911)	[1,179]	{589}
Williamson	28,637	28,640	28,652	28,659	28,666	(5,733)	[1,376]	{688}	28,673	(5,735)	[1,376]	{688}	28,680	(5,736)	[1,377]	{688}

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.