

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

Date: 6/2/21

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 6/2/21 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.

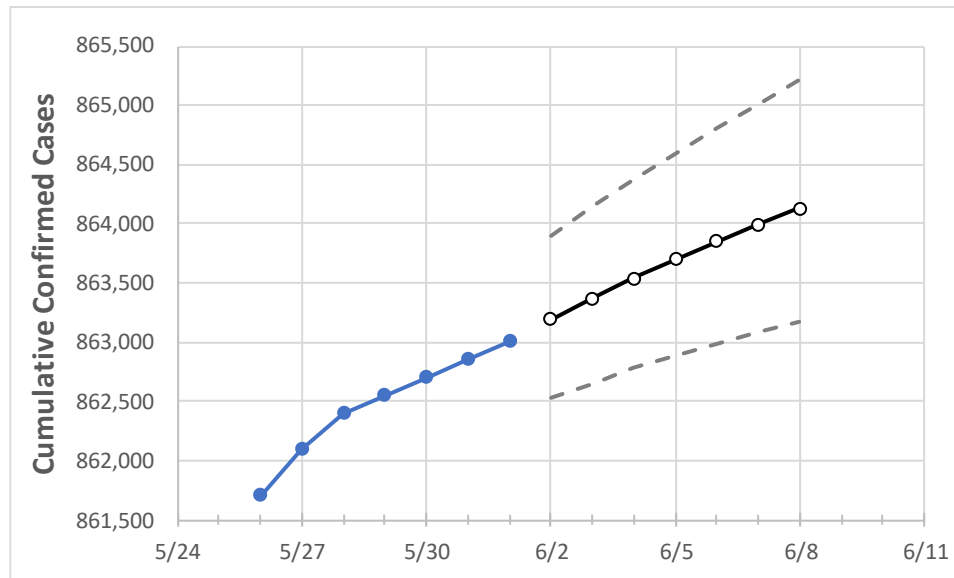
IEM's Modeling Lead

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:							
	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	
Tennessee	862,552	862,703	862,853	863,004	863,192	863,371	863,541	863,698	863,850	863,996	864,130	

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:							
	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	
Blount	15,621	15,626	15,630	15,634	15,637	15,640	15,642	15,644	15,646	15,649	15,651	
Davidson	90,107	90,122	90,136	90,150	90,165	90,179	90,192	90,205	90,217	90,229	90,240	
Hamilton	44,990	45,004	45,018	45,032	45,052	45,071	45,089	45,106	45,123	45,140	45,156	
Knox	51,669	51,661	51,653	51,645	51,702	51,760	51,819	51,878	51,942	52,006	52,072	
Rutherford	43,457	43,466	43,475	43,484	43,493	43,503	43,511	43,520	43,527	43,535	43,542	
Shelby	97,610	97,645	97,679	97,713	97,759	97,803	97,844	97,886	97,925	97,961	97,996	
Sumner	24,307	24,308	24,309	24,310	24,315	24,321	24,326	24,330	24,335	24,339	24,343	
Williamson	28,267	28,274	28,281	28,288	28,294	28,300	28,306	28,312	28,317	28,322	28,327	

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:											
	5/29	5/30	5/31	6/1	6/3				6/5				6/7			
Blount	15,621	15,626	15,630	15,634	15,640	(3,128)	[751]	{375}	15,644	(3,129)	[751]	{375}	15,649	(3,130)	[751]	{376}
Davidson	90,107	90,122	90,136	90,150	90,179	(18,036)	[4,329]	{2,164}	90,205	(18,041)	[4,330]	{2,165}	90,229	(18,046)	[4,331]	{2,165}
Hamilton	44,990	45,004	45,018	45,032	45,071	(9,014)	[2,163]	{1,082}	45,106	(9,021)	[2,165]	{1,083}	45,140	(9,028)	[2,167]	{1,083}
Knox	51,669	51,661	51,653	51,645	51,760	(10,352)	[2,484]	{1,242}	51,878	(10,376)	[2,490]	{1,245}	52,006	(10,401)	[2,496]	{1,248}
Rutherford	43,457	43,466	43,475	43,484	43,503	(8,701)	[2,088]	{1,044}	43,520	(8,704)	[2,089]	{1,044}	43,535	(8,707)	[2,090]	{1,045}
Shelby	97,610	97,645	97,679	97,713	97,803	(19,561)	[4,695]	{2,347}	97,886	(19,577)	[4,699]	{2,349}	97,961	(19,592)	[4,702]	{2,351}
Sumner	24,307	24,308	24,309	24,310	24,321	(4,864)	[1,167]	{584}	24,330	(4,866)	[1,168]	{584}	24,339	(4,868)	[1,168]	{584}
Williamson	28,267	28,274	28,281	28,288	28,300	(5,660)	[1,358]	{679}	28,312	(5,662)	[1,359]	{679}	28,322	(5,664)	[1,359]	{680}

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.