

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

Date: 4/29/21

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 4/29/21 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.

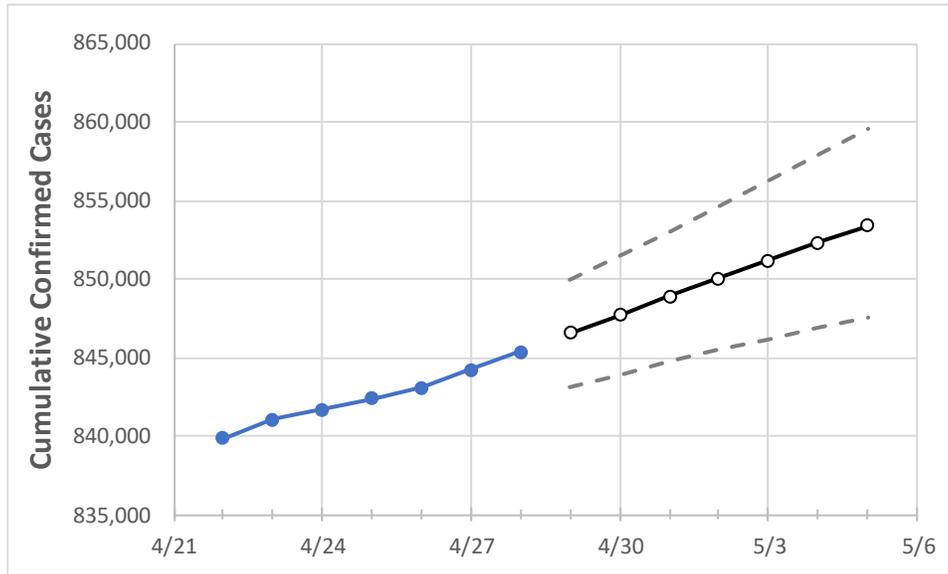
IEM's Modeling Lead

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
Tennessee	842,389	843,059	844,246	845,380	846,556	847,722	848,873	850,019	851,152	852,307	853,429

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:						
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5
Blount	15,278	15,292	15,319	15,341	15,366	15,391	15,418	15,443	15,468	15,494	15,518
Davidson	88,588	88,643	88,773	88,839	88,938	89,037	89,132	89,228	89,325	89,421	89,514
Hamilton	43,701	43,732	43,783	43,826	43,870	43,913	43,956	43,996	44,036	44,076	44,114
Knox	50,130	50,161	50,227	50,272	50,329	50,385	50,441	50,496	50,551	50,608	50,661
Rutherford	42,602	42,631	42,701	42,746	42,799	42,849	42,901	42,949	42,995	43,040	43,084
Shelby	93,982	94,112	94,240	94,421	94,563	94,704	94,844	94,985	95,123	95,264	95,406
Sumner	23,671	23,692	23,754	23,790	23,834	23,877	23,921	23,966	24,008	24,052	24,094
Williamson	27,708	27,730	27,756	27,807	27,845	27,882	27,919	27,955	27,991	28,026	28,060

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:											
	4/25	4/26	4/27	4/28	4/30				5/2				5/4			
Blount	15,278	15,292	15,319	15,341	15,391	(3,078)	[739]	{369}	15,443	(3,089)	[741]	{371}	15,494	(3,099)	[744]	{372}
Davidson	88,588	88,643	88,773	88,839	89,037	(17,807)	[4,274]	{2,137}	89,228	(17,846)	[4,283]	{2,141}	89,421	(17,884)	[4,292]	{2,146}
Hamilton	43,701	43,732	43,783	43,826	43,913	(8,783)	[2,108]	{1,054}	43,996	(8,799)	[2,112]	{1,056}	44,076	(8,815)	[2,116]	{1,058}
Knox	50,130	50,161	50,227	50,272	50,385	(10,077)	[2,418]	{1,209}	50,496	(10,099)	[2,424]	{1,212}	50,608	(10,122)	[2,429]	{1,215}
Rutherford	42,602	42,631	42,701	42,746	42,849	(8,570)	[2,057]	{1,028}	42,949	(8,590)	[2,062]	{1,031}	43,040	(8,608)	[2,066]	{1,033}
Shelby	93,982	94,112	94,240	94,421	94,704	(18,941)	[4,546]	{2,273}	94,985	(18,997)	[4,559]	{2,280}	95,264	(19,053)	[4,573]	{2,286}
Sumner	23,671	23,692	23,754	23,790	23,877	(4,775)	[1,146]	{573}	23,966	(4,793)	[1,150]	{575}	24,052	(4,810)	[1,155]	{577}
Williamson	27,708	27,730	27,756	27,807	27,882	(5,576)	[1,338]	{669}	27,955	(5,591)	[1,342]	{671}	28,026	(5,605)	[1,345]	{673}

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.