

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

Date: 5/7/21

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 5/7/21 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.

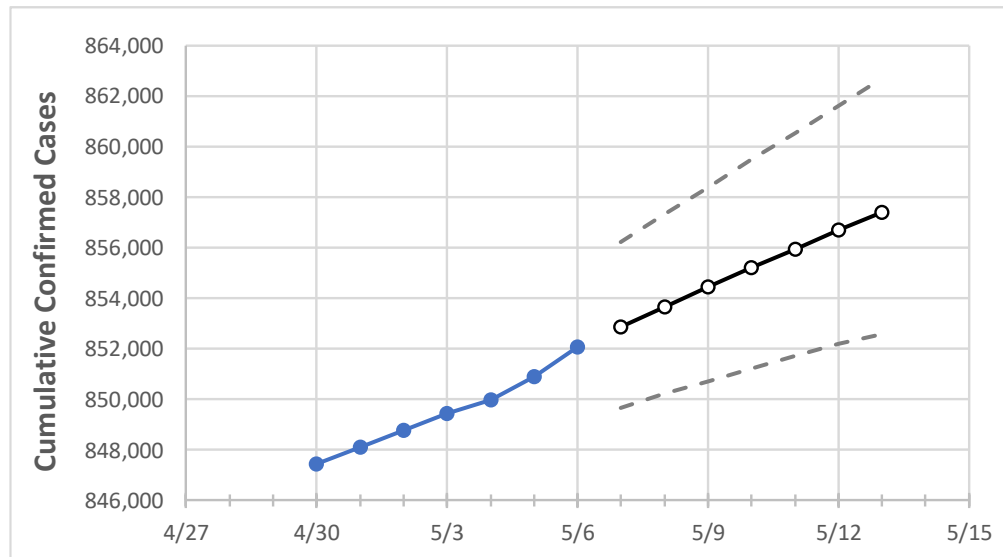
IEM's Modeling Lead

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:						
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13
Tennessee	849,436	849,978	850,885	852,072	852,870	853,662	854,452	855,207	855,942	856,691	857,403

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:						
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13
Blount	15,434	15,441	15,468	15,486	15,504	15,522	15,541	15,560	15,580	15,599	15,618
Davidson	89,143	89,184	89,250	89,317	89,370	89,422	89,473	89,522	89,569	89,616	89,661
Hamilton	44,078	44,114	44,186	44,219	44,262	44,304	44,346	44,388	44,428	44,468	44,508
Knox	50,489	50,513	50,562	50,606	50,642	50,677	50,713	50,747	50,781	50,813	50,844
Rutherford	42,925	42,950	42,989	43,026	43,058	43,089	43,119	43,149	43,178	43,207	43,235
Shelby	95,106	95,208	95,375	95,525	95,661	95,797	95,931	96,062	96,195	96,328	96,459
Sumner	23,910	23,921	23,951	23,978	24,002	24,025	24,048	24,070	24,092	24,113	24,133
Williamson	27,914	27,935	27,959	27,986	28,008	28,030	28,051	28,073	28,094	28,115	28,134

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:											
	5/3	5/4	5/5	5/6	5/8				5/10				5/12			
Blount	15,434	15,441	15,468	15,486	15,522	(3,104)	[745]	{373}	15,560	(3,112)	[747]	{373}	15,599	(3,120)	[749]	{374}
Davidson	89,143	89,184	89,250	89,317	89,422	(17,884)	[4,292]	{2,146}	89,522	(17,904)	[4,297]	{2,149}	89,616	(17,923)	[4,302]	{2,151}
Hamilton	44,078	44,114	44,186	44,219	44,304	(8,861)	[2,127]	{1,063}	44,388	(8,878)	[2,131]	{1,065}	44,468	(8,894)	[2,134]	{1,067}
Knox	50,489	50,513	50,562	50,606	50,677	(10,135)	[2,433]	{1,216}	50,747	(10,149)	[2,436]	{1,218}	50,813	(10,163)	[2,439]	{1,220}
Rutherford	42,925	42,950	42,989	43,026	43,089	(8,618)	[2,068]	{1,034}	43,149	(8,630)	[2,071]	{1,036}	43,207	(8,641)	[2,074]	{1,037}
Shelby	95,106	95,208	95,375	95,525	95,797	(19,159)	[4,598]	{2,299}	96,062	(19,212)	[4,611]	{2,305}	96,328	(19,266)	[4,624]	{2,312}
Sumner	23,910	23,921	23,951	23,978	24,025	(4,805)	[1,153]	{577}	24,070	(4,814)	[1,155]	{578}	24,113	(4,823)	[1,157]	{579}
Williamson	27,914	27,935	27,959	27,986	28,030	(5,606)	[1,345]	{673}	28,073	(5,615)	[1,347]	{674}	28,115	(5,623)	[1,349]	{675}

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.