

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

Date: 3/23/21

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 3/23/21 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.

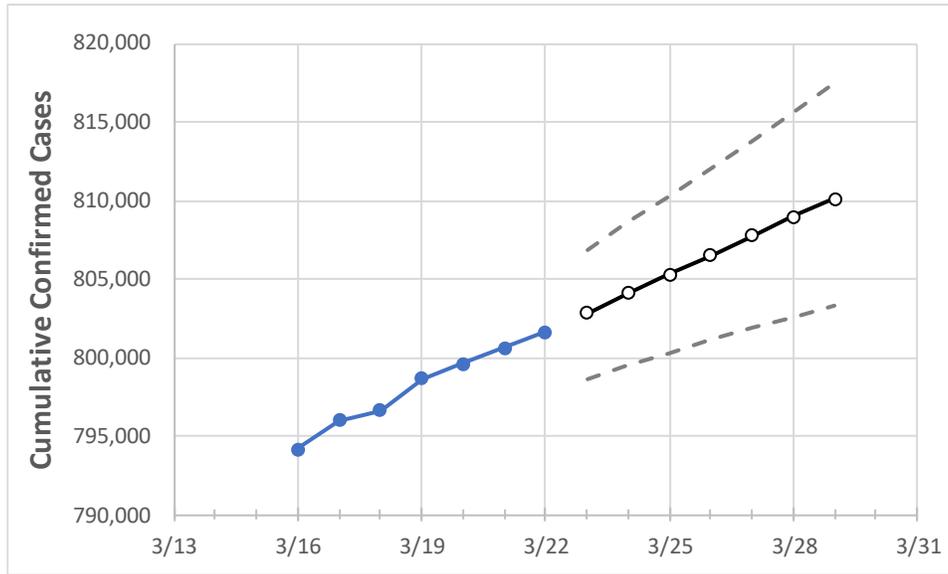
IEM's Modeling Lead

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Tennessee	798,621	799,629	800,637	801,645	802,846	804,078	805,301	806,531	807,737	808,944	810,097

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Blount	14,498	14,517	14,535	14,554	14,574	14,595	14,616	14,636	14,656	14,676	14,695
Davidson	83,993	84,096	84,200	84,303	84,432	84,562	84,687	84,812	84,945	85,078	85,205
Hamilton	41,640	41,691	41,741	41,792	41,858	41,924	41,990	42,055	42,121	42,186	42,252
Knox	47,431	47,510	47,588	47,667	47,729	47,791	47,850	47,907	47,961	48,018	48,072
Rutherford	39,910	39,976	40,041	40,107	40,189	40,272	40,352	40,434	40,514	40,596	40,676
Shelby	89,228	89,327	89,425	89,524	89,622	89,719	89,815	89,912	90,006	90,099	90,192
Sumner	22,074	22,105	22,135	22,166	22,206	22,245	22,283	22,323	22,362	22,400	22,439
Williamson	26,058	26,097	26,137	26,176	26,218	26,259	26,299	26,338	26,379	26,419	26,457

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:											
	3/19	3/20	3/21	3/22	3/24				3/26				3/28			
Blount	14,498	14,517	14,535	14,554	14,595	(2,919)	[701]	{350}	14,636	(2,927)	[703]	{351}	14,676	(2,935)	[704]	{352}
Davidson	83,993	84,096	84,200	84,303	84,562	(16,912)	[4,059]	{2,029}	84,812	(16,962)	[4,071]	{2,035}	85,078	(17,016)	[4,084]	{2,042}
Hamilton	41,640	41,691	41,741	41,792	41,924	(8,385)	[2,012]	{1,006}	42,055	(8,411)	[2,019]	{1,009}	42,186	(8,437)	[2,025]	{1,012}
Knox	47,431	47,510	47,588	47,667	47,791	(9,558)	[2,294]	{1,147}	47,907	(9,581)	[2,300]	{1,150}	48,018	(9,604)	[2,305]	{1,152}
Rutherford	39,910	39,976	40,041	40,107	40,272	(8,054)	[1,933]	{967}	40,434	(8,087)	[1,941]	{970}	40,596	(8,119)	[1,949]	{974}
Shelby	89,228	89,327	89,425	89,524	89,719	(17,944)	[4,306]	{2,153}	89,912	(17,982)	[4,316]	{2,158}	90,099	(18,020)	[4,325]	{2,162}
Sumner	22,074	22,105	22,135	22,166	22,245	(4,449)	[1,068]	{534}	22,323	(4,465)	[1,071]	{536}	22,400	(4,480)	[1,075]	{538}
Williamson	26,058	26,097	26,137	26,176	26,259	(5,252)	[1,260]	{630}	26,338	(5,268)	[1,264]	{632}	26,419	(5,284)	[1,268]	{634}

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.