

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

Date: 3/22/21

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 3/22/21 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.

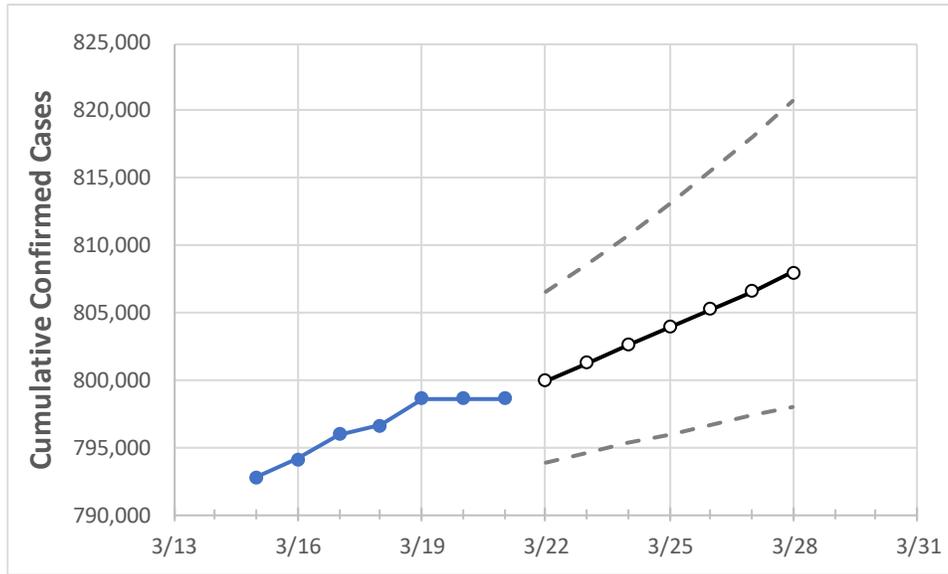
IEM's Modeling Lead

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Tennessee	796,624	798,621	798,621	798,621	799,938	801,305	802,636	803,962	805,290	806,607	807,971

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Blount	14,456	14,498	14,498	14,498	14,519	14,542	14,565	14,586	14,607	14,629	14,651
Davidson	83,747	83,993	83,993	83,993	84,141	84,289	84,438	84,593	84,742	84,896	85,052
Hamilton	41,501	41,640	41,640	41,640	41,715	41,793	41,871	41,948	42,026	42,106	42,184
Knox	47,324	47,431	47,431	47,431	47,485	47,537	47,588	47,638	47,686	47,733	47,776
Rutherford	39,787	39,910	39,910	39,910	39,997	40,089	40,180	40,271	40,361	40,456	40,549
Shelby	89,086	89,228	89,228	89,228	89,314	89,402	89,487	89,571	89,652	89,732	89,810
Sumner	22,008	22,074	22,074	22,074	22,115	22,155	22,197	22,238	22,281	22,324	22,367
Williamson	25,973	26,058	26,058	26,058	26,099	26,141	26,182	26,224	26,266	26,307	26,349

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:											
	3/18	3/19	3/20	3/21	3/23				3/25				3/27			
Blount	14,456	14,498	14,498	14,498	14,542	(2,908)	[698]	{349}	14,586	(2,917)	[700]	{350}	14,629	(2,926)	[702]	{351}
Davidson	83,747	83,993	83,993	83,993	84,289	(16,858)	[4,046]	{2,023}	84,593	(16,919)	[4,060]	{2,030}	84,896	(16,979)	[4,075]	{2,037}
Hamilton	41,501	41,640	41,640	41,640	41,793	(8,359)	[2,006]	{1,003}	41,948	(8,390)	[2,013]	{1,007}	42,106	(8,421)	[2,021]	{1,011}
Knox	47,324	47,431	47,431	47,431	47,537	(9,507)	[2,282]	{1,141}	47,638	(9,528)	[2,287]	{1,143}	47,733	(9,547)	[2,291]	{1,146}
Rutherford	39,787	39,910	39,910	39,910	40,089	(8,018)	[1,924]	{962}	40,271	(8,054)	[1,933]	{966}	40,456	(8,091)	[1,942]	{971}
Shelby	89,086	89,228	89,228	89,228	89,402	(17,880)	[4,291]	{2,146}	89,571	(17,914)	[4,299]	{2,150}	89,732	(17,946)	[4,307]	{2,154}
Sumner	22,008	22,074	22,074	22,074	22,155	(4,431)	[1,063]	{532}	22,238	(4,448)	[1,067]	{534}	22,324	(4,465)	[1,072]	{536}
Williamson	25,973	26,058	26,058	26,058	26,141	(5,228)	[1,255]	{627}	26,224	(5,245)	[1,259]	{629}	26,307	(5,261)	[1,263]	{631}

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.