

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

Date: 3/5/21

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 3/5/21 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.

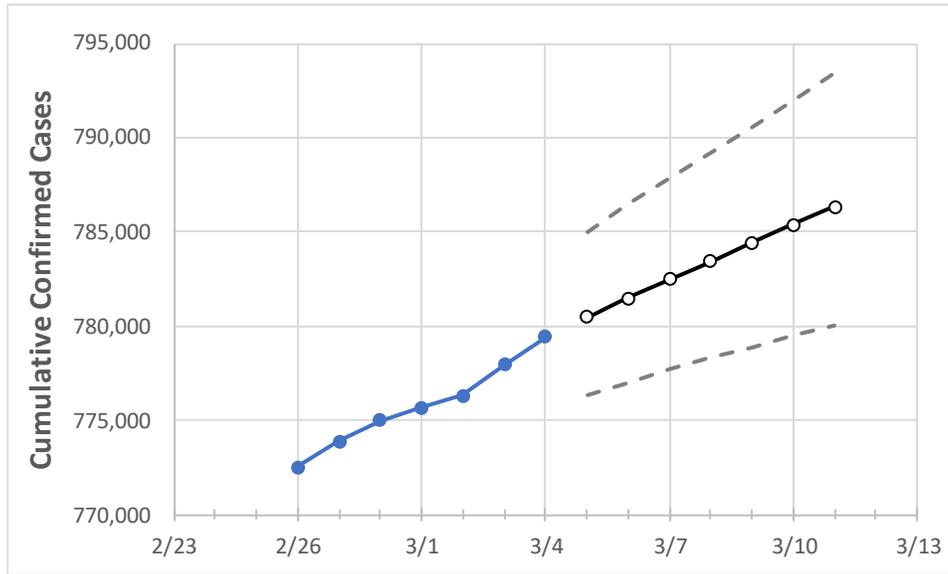
IEM's Modeling Lead

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:							
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	
Tennessee	775,693	776,337	777,935	779,449	780,460	781,459	782,461	783,449	784,460	785,393	786,316	

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:							
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	
Blount	14,050	14,066	14,106	14,141	14,159	14,176	14,192	14,208	14,223	14,238	14,252	
Davidson	81,463	81,556	81,719	81,809	81,897	81,982	82,060	82,136	82,210	82,283	82,352	
Hamilton	40,359	40,396	40,486	40,539	40,600	40,660	40,719	40,773	40,827	40,878	40,928	
Knox	45,959	46,018	46,146	46,250	46,352	46,446	46,540	46,635	46,728	46,816	46,901	
Rutherford	38,346	38,385	38,479	38,563	38,631	38,697	38,760	38,824	38,886	38,949	39,008	
Shelby	87,261	87,316	87,443	87,618	87,716	87,808	87,898	87,983	88,063	88,148	88,222	
Sumner	21,354	21,383	21,415	21,448	21,478	21,508	21,537	21,566	21,593	21,620	21,647	
Williamson	25,267	25,282	25,338	25,382	25,420	25,457	25,492	25,526	25,559	25,592	25,623	

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:											
	3/1	3/2	3/3	3/4	3/6			3/8			3/10					
Blount	14,050	14,066	14,106	14,141	14,176	(2,835)	[680]	{340}	14,208	(2,842)	[682]	{341}	14,238	(2,848)	[683]	{342}
Davidson	81,463	81,556	81,719	81,809	81,982	(16,396)	[3,935]	{1,968}	82,136	(16,427)	[3,943]	{1,971}	82,283	(16,457)	[3,950]	{1,975}
Hamilton	40,359	40,396	40,486	40,539	40,660	(8,132)	[1,952]	{976}	40,773	(8,155)	[1,957]	{979}	40,878	(8,176)	[1,962]	{981}
Knox	45,959	46,018	46,146	46,250	46,446	(9,289)	[2,229]	{1,115}	46,635	(9,327)	[2,238]	{1,119}	46,816	(9,363)	[2,247]	{1,124}
Rutherford	38,346	38,385	38,479	38,563	38,697	(7,739)	[1,857]	{929}	38,824	(7,765)	[1,864]	{932}	38,949	(7,790)	[1,870]	{935}
Shelby	87,261	87,316	87,443	87,618	87,808	(17,562)	[4,215]	{2,107}	87,983	(17,597)	[4,223]	{2,112}	88,148	(17,630)	[4,231]	{2,116}
Sumner	21,354	21,383	21,415	21,448	21,508	(4,302)	[1,032]	{516}	21,566	(4,313)	[1,035]	{518}	21,620	(4,324)	[1,038]	{519}
Williamson	25,267	25,282	25,338	25,382	25,457	(5,091)	[1,222]	{611}	25,526	(5,105)	[1,225]	{613}	25,592	(5,118)	[1,228]	{614}

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.