

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

Date: 3/24/21

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 3/24/21 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.

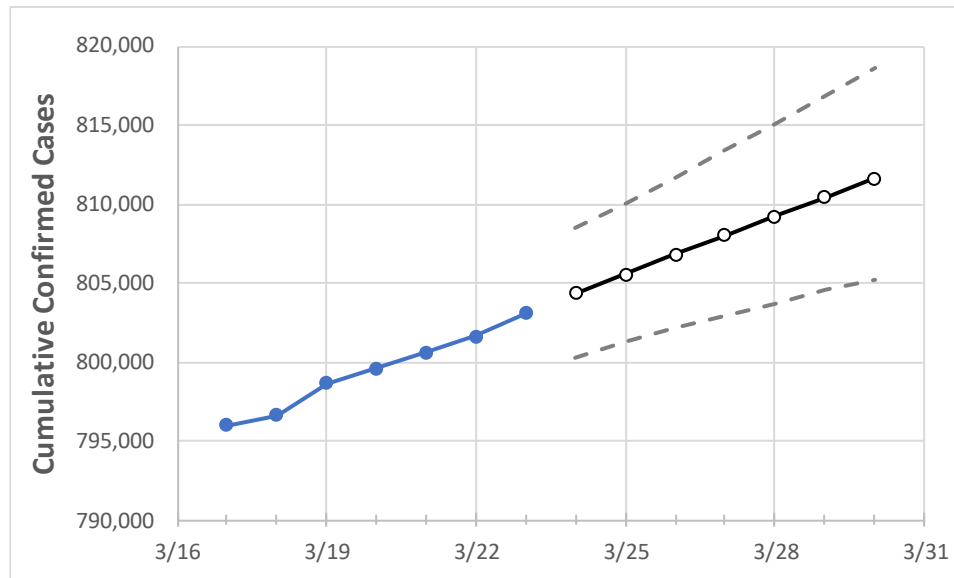
IEM's Modeling Lead

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Tennessee	799,629	800,637	801,645	803,104	804,341	805,573	806,811	808,044	809,233	810,454	811,635

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Blount	14,517	14,535	14,554	14,575	14,596	14,616	14,637	14,658	14,679	14,700	14,719
Davidson	84,096	84,200	84,303	84,489	84,627	84,767	84,907	85,046	85,181	85,317	85,459
Hamilton	41,691	41,741	41,792	41,900	41,971	42,042	42,111	42,182	42,252	42,322	42,392
Knox	47,510	47,588	47,667	47,770	47,838	47,906	47,972	48,037	48,102	48,165	48,229
Rutherford	39,976	40,041	40,107	40,196	40,277	40,361	40,443	40,527	40,608	40,686	40,769
Shelby	89,327	89,425	89,524	89,625	89,716	89,806	89,894	89,981	90,069	90,157	90,244
Sumner	22,105	22,135	22,166	22,207	22,247	22,287	22,326	22,365	22,406	22,446	22,485
Williamson	26,097	26,137	26,176	26,223	26,265	26,307	26,350	26,393	26,436	26,478	26,519

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:											
	3/20	3/21	3/22	3/23	3/25				3/27				3/29			
Blount	14,517	14,535	14,554	14,575	14,616	(2,923)	[702]	{351}	14,658	(2,932)	[704]	{352}	14,700	(2,940)	[706]	{353}
Davidson	84,096	84,200	84,303	84,489	84,767	(16,953)	[4,069]	{2,034}	85,046	(17,009)	[4,082]	{2,041}	85,317	(17,063)	[4,095]	{2,048}
Hamilton	41,691	41,741	41,792	41,900	42,042	(8,408)	[2,018]	{1,009}	42,182	(8,436)	[2,025]	{1,012}	42,322	(8,464)	[2,031]	{1,016}
Knox	47,510	47,588	47,667	47,770	47,906	(9,581)	[2,299]	{1,150}	48,037	(9,607)	[2,306]	{1,153}	48,165	(9,633)	[2,312]	{1,156}
Rutherford	39,976	40,041	40,107	40,196	40,361	(8,072)	[1,937]	{969}	40,527	(8,105)	[1,945]	{973}	40,686	(8,137)	[1,953]	{976}
Shelby	89,327	89,425	89,524	89,625	89,806	(17,961)	[4,311]	{2,155}	89,981	(17,996)	[4,319]	{2,160}	90,157	(18,031)	[4,328]	{2,164}
Sumner	22,105	22,135	22,166	22,207	22,287	(4,457)	[1,070]	{535}	22,365	(4,473)	[1,074]	{537}	22,446	(4,489)	[1,077]	{539}
Williamson	26,097	26,137	26,176	26,223	26,307	(5,261)	[1,263]	{631}	26,393	(5,279)	[1,267]	{633}	26,478	(5,296)	[1,271]	{635}

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.