

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

Date: 8/4/21

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 8/4/21 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.

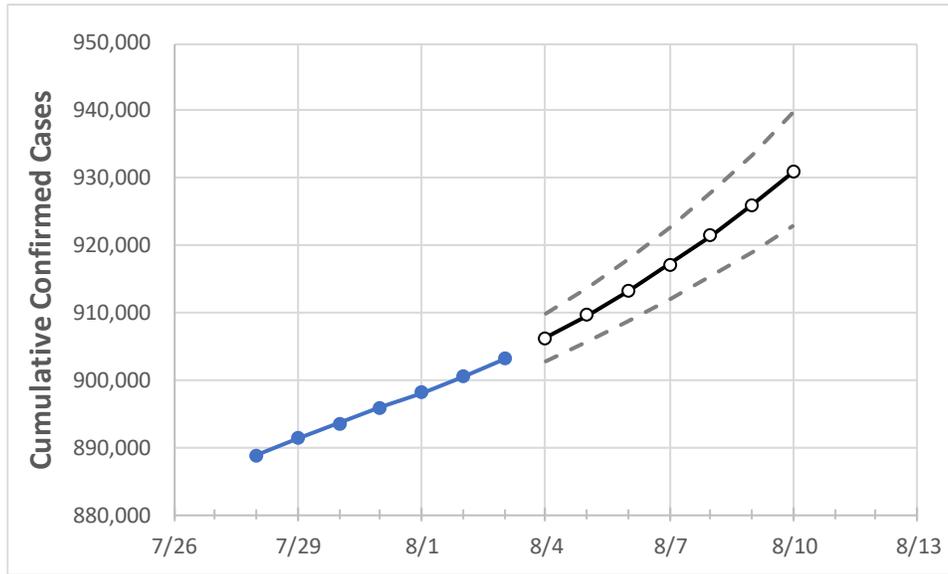
IEM's Modeling Lead

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Tennessee	895,842	898,130	900,418	903,095	906,201	909,577	913,207	917,148	921,453	925,980	930,858

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Blount	16,362	16,391	16,419	16,456	16,498	16,542	16,590	16,641	16,696	16,755	16,818
Davidson	92,920	93,131	93,343	93,636	93,923	94,236	94,569	94,931	95,325	95,747	96,202
Hamilton	47,125	47,254	47,382	47,484	47,648	47,818	48,006	48,202	48,415	48,639	48,884
Knox	53,448	53,558	53,668	53,765	53,909	54,067	54,234	54,415	54,610	54,816	55,038
Rutherford	44,982	45,079	45,177	45,298	45,438	45,587	45,747	45,916	46,100	46,297	46,511
Shelby	104,665	105,145	105,625	105,991	106,534	107,121	107,741	108,393	109,094	109,831	110,636
Sumner	25,459	25,519	25,579	25,647	25,717	25,792	25,871	25,955	26,041	26,133	26,230
Williamson	29,708	29,801	29,895	29,994	30,116	30,252	30,400	30,561	30,737	30,928	31,135

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:											
	7/31	8/1	8/2	8/3	8/5			8/7			8/9					
Blount	16,362	16,391	16,419	16,456	16,542	(3,308)	[794]	{397}	16,641	(3,328)	[799]	{399}	16,755	(3,351)	[804]	{402}
Davidson	92,920	93,131	93,343	93,636	94,236	(18,847)	[4,523]	{2,262}	94,931	(18,986)	[4,557]	{2,278}	95,747	(19,149)	[4,596]	{2,298}
Hamilton	47,125	47,254	47,382	47,484	47,818	(9,564)	[2,295]	{1,148}	48,202	(9,640)	[2,314]	{1,157}	48,639	(9,728)	[2,335]	{1,167}
Knox	53,448	53,558	53,668	53,765	54,067	(10,813)	[2,595]	{1,298}	54,415	(10,883)	[2,612]	{1,306}	54,816	(10,963)	[2,631]	{1,316}
Rutherford	44,982	45,079	45,177	45,298	45,587	(9,117)	[2,188]	{1,094}	45,916	(9,183)	[2,204]	{1,102}	46,297	(9,259)	[2,222]	{1,111}
Shelby	104,665	105,145	105,625	105,991	107,121	(21,424)	[5,142]	{2,571}	108,393	(21,679)	[5,203]	{2,601}	109,831	(21,966)	[5,272]	{2,636}
Sumner	25,459	25,519	25,579	25,647	25,792	(5,158)	[1,238]	{619}	25,955	(5,191)	[1,246]	{623}	26,133	(5,227)	[1,254]	{627}
Williamson	29,708	29,801	29,895	29,994	30,252	(6,050)	[1,452]	{726}	30,561	(6,112)	[1,467]	{733}	30,928	(6,186)	[1,485]	{742}

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.