

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

Date: 8/11/21

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 8/11/21 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.

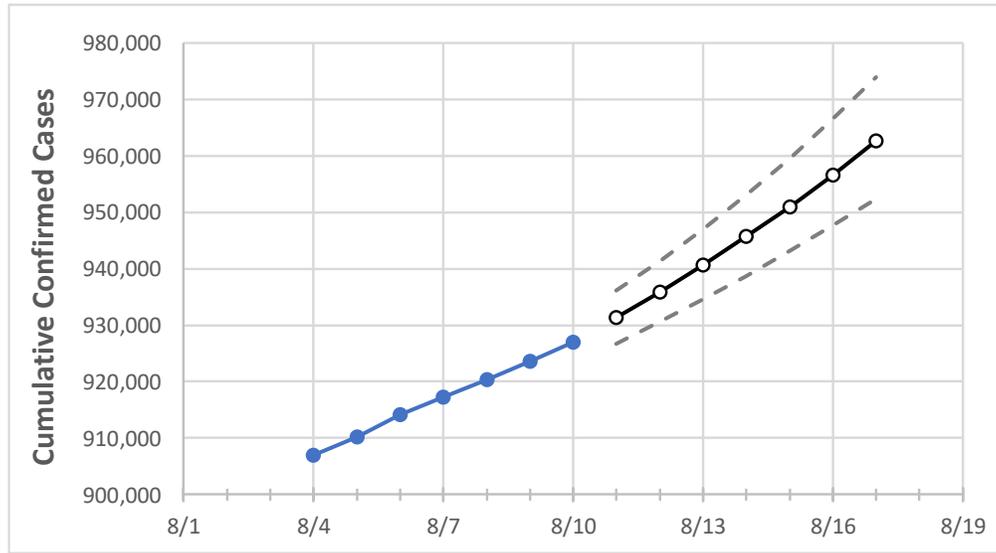
IEM's Modeling Lead

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:							
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	
Tennessee	917,247	920,383	923,520	927,010	931,330	935,834	940,611	945,654	950,957	956,605	962,572	

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:							
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	
Blount	16,751	16,797	16,843	16,921	16,999	17,082	17,172	17,271	17,378	17,490	17,610	
Davidson	94,919	95,201	95,482	95,696	96,050	96,427	96,818	97,225	97,658	98,116	98,585	
Hamilton	48,251	48,391	48,531	48,794	49,027	49,278	49,540	49,818	50,114	50,426	50,754	
Knox	54,456	54,589	54,722	54,914	55,111	55,320	55,539	55,773	56,019	56,280	56,555	
Rutherford	45,831	45,953	46,075	46,205	46,360	46,521	46,687	46,860	47,041	47,232	47,425	
Shelby	108,380	108,987	109,594	110,069	110,755	111,471	112,221	113,000	113,818	114,669	115,549	
Sumner	25,998	26,075	26,151	26,234	26,337	26,446	26,561	26,682	26,810	26,943	27,083	
Williamson	30,439	30,539	30,638	30,737	30,861	30,990	31,122	31,261	31,405	31,553	31,707	

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:											
	8/7	8/8	8/9	8/10	8/12			8/14			8/16					
Blount	16,751	16,797	16,843	16,921	17,082	(3,416)	[820]	{410}	17,271	(3,454)	[829]	{415}	17,490	(3,498)	[840]	{420}
Davidson	94,919	95,201	95,482	95,696	96,427	(19,285)	[4,629]	{2,314}	97,225	(19,445)	[4,667]	{2,333}	98,116	(19,623)	[4,710]	{2,355}
Hamilton	48,251	48,391	48,531	48,794	49,278	(9,856)	[2,365]	{1,183}	49,818	(9,964)	[2,391]	{1,196}	50,426	(10,085)	[2,420]	{1,210}
Knox	54,456	54,589	54,722	54,914	55,320	(11,064)	[2,655]	{1,328}	55,773	(11,155)	[2,677]	{1,339}	56,280	(11,256)	[2,701]	{1,351}
Rutherford	45,831	45,953	46,075	46,205	46,521	(9,304)	[2,233]	{1,116}	46,860	(9,372)	[2,249]	{1,125}	47,232	(9,446)	[2,267]	{1,134}
Shelby	108,380	108,987	109,594	110,069	111,471	(22,294)	[5,351]	{2,675}	113,000	(22,600)	[5,424]	{2,712}	114,669	(22,934)	[5,504]	{2,752}
Sumner	25,998	26,075	26,151	26,234	26,446	(5,289)	[1,269]	{635}	26,682	(5,336)	[1,281]	{640}	26,943	(5,389)	[1,293]	{647}
Williamson	30,439	30,539	30,638	30,737	30,990	(6,198)	[1,488]	{744}	31,261	(6,252)	[1,501]	{750}	31,553	(6,311)	[1,515]	{757}

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.