

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

Date: 7/12/21

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 7/12/21 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.

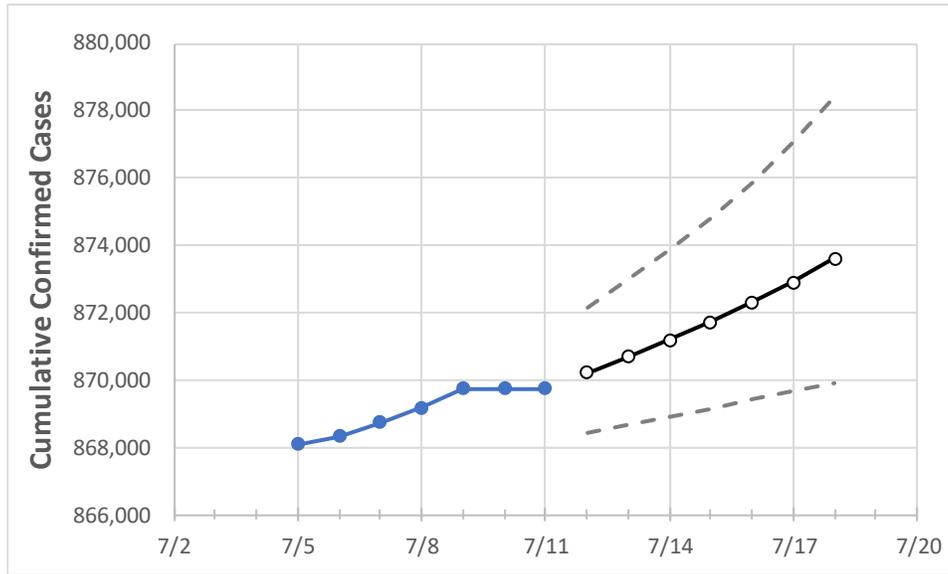
IEM's Modeling Lead

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:						
	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18
Tennessee	869,191	869,752	869,752	869,752	870,207	870,676	871,186	871,723	872,309	872,917	873,601

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:						
	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18
Blount	15,970	15,976	15,976	15,976	15,981	15,985	15,990	15,994	15,998	16,003	16,007
Davidson	90,551	90,612	90,612	90,612	90,654	90,701	90,753	90,808	90,867	90,931	90,996
Hamilton	45,589	45,632	45,632	45,632	45,658	45,686	45,714	45,744	45,774	45,806	45,839
Knox	52,207	52,225	52,225	52,225	52,232	52,240	52,247	52,254	52,262	52,269	52,276
Rutherford	43,799	43,818	43,818	43,818	43,831	43,844	43,858	43,871	43,886	43,901	43,918
Shelby	99,258	99,438	99,438	99,438	99,568	99,711	99,868	100,033	100,213	100,404	100,613
Sumner	24,657	24,687	24,687	24,687	24,717	24,750	24,784	24,823	24,865	24,911	24,962
Williamson	28,714	28,732	28,732	28,732	28,745	28,759	28,773	28,788	28,805	28,823	28,842

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:											
	7/8	7/9	7/10	7/11	7/13			7/15			7/17					
Blount	15,970	15,976	15,976	15,976	15,985	(3,197)	[767]	{384}	15,994	(3,199)	[768]	{384}	16,003	(3,201)	[768]	{384}
Davidson	90,551	90,612	90,612	90,612	90,701	(18,140)	[4,354]	{2,177}	90,808	(18,162)	[4,359]	{2,179}	90,931	(18,186)	[4,365]	{2,182}
Hamilton	45,589	45,632	45,632	45,632	45,686	(9,137)	[2,193]	{1,096}	45,744	(9,149)	[2,196]	{1,098}	45,806	(9,161)	[2,199]	{1,099}
Knox	52,207	52,225	52,225	52,225	52,240	(10,448)	[2,508]	{1,254}	52,254	(10,451)	[2,508]	{1,254}	52,269	(10,454)	[2,509]	{1,254}
Rutherford	43,799	43,818	43,818	43,818	43,844	(8,769)	[2,105]	{1,052}	43,871	(8,774)	[2,106]	{1,053}	43,901	(8,780)	[2,107]	{1,054}
Shelby	99,258	99,438	99,438	99,438	99,711	(19,942)	[4,786]	{2,393}	100,033	(20,007)	[4,802]	{2,401}	100,404	(20,081)	[4,819]	{2,410}
Sumner	24,657	24,687	24,687	24,687	24,750	(4,950)	[1,188]	{594}	24,823	(4,965)	[1,191]	{596}	24,911	(4,982)	[1,196]	{598}
Williamson	28,714	28,732	28,732	28,732	28,759	(5,752)	[1,380]	{690}	28,788	(5,758)	[1,382]	{691}	28,823	(5,765)	[1,383]	{692}

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.