

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 10/11/21**

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 10/11/21 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.

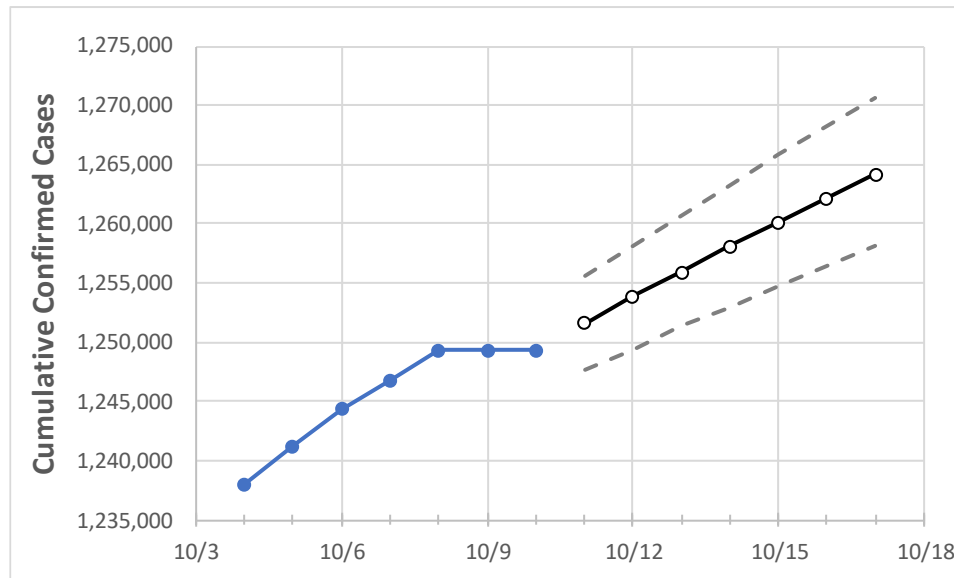
IEM's Modeling Lead

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:						
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17
Tennessee	1,246,815	1,249,333	1,249,333	1,249,333	1,251,564	1,253,838	1,255,944	1,258,086	1,260,119	1,262,186	1,264,181

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:						
	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17
Blount	23,048	23,127	23,127	23,127	23,177	23,224	23,269	23,310	23,355	23,398	23,439
Davidson	118,347	118,736	118,736	118,736	118,949	119,146	119,341	119,542	119,734	119,933	120,127
Hamilton	61,858	62,034	62,034	62,034	62,132	62,231	62,323	62,418	62,508	62,601	62,687
Knox	75,956	76,338	76,338	76,338	76,507	76,677	76,833	76,994	77,150	77,302	77,447
Rutherford	60,387	60,556	60,556	60,556	60,635	60,710	60,786	60,856	60,928	60,994	61,059
Shelby	141,656	141,997	141,997	141,997	142,197	142,385	142,573	142,765	142,943	143,121	143,294
Sumner	33,446	33,528	33,528	33,528	33,575	33,621	33,667	33,712	33,755	33,798	33,837
Williamson	38,691	38,825	38,825	38,825	38,887	38,946	39,008	39,063	39,122	39,181	39,233

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:											
	10/7	10/8	10/9	10/10	10/12				10/14				10/16			
Blount	23,048	23,127	23,127	23,127	23,224	(4,645)	[1,115]	{557}	23,310	(4,662)	[1,119]	{559}	23,398	(4,680)	[1,123]	{562}
Davidson	118,347	118,736	118,736	118,736	119,146	(23,829)	[5,719]	{2,860}	119,542	(23,908)	[5,738]	{2,869}	119,933	(23,987)	[5,757]	{2,878}
Hamilton	61,858	62,034	62,034	62,034	62,231	(12,446)	[2,987]	{1,494}	62,418	(12,484)	[2,996]	{1,498}	62,601	(12,520)	[3,005]	{1,502}
Knox	75,956	76,338	76,338	76,338	76,677	(15,335)	[3,681]	{1,840}	76,994	(15,399)	[3,696]	{1,848}	77,302	(15,460)	[3,711]	{1,855}
Rutherford	60,387	60,556	60,556	60,556	60,710	(12,142)	[2,914]	{1,457}	60,856	(12,171)	[2,921]	{1,461}	60,994	(12,199)	[2,928]	{1,464}
Shelby	141,656	141,997	141,997	141,997	142,385	(28,477)	[6,834]	{3,417}	142,765	(28,553)	[6,853]	{3,426}	143,121	(28,624)	[6,870]	{3,435}
Sumner	33,446	33,528	33,528	33,528	33,621	(6,724)	[1,614]	{807}	33,712	(6,742)	[1,618]	{809}	33,798	(6,760)	[1,622]	{811}
Williamson	38,691	38,825	38,825	38,825	38,946	(7,789)	[1,869]	{935}	39,063	(7,813)	[1,875]	{938}	39,181	(7,836)	[1,881]	{940}

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.