

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

Date: 5/6/21

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 5/6/21 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.

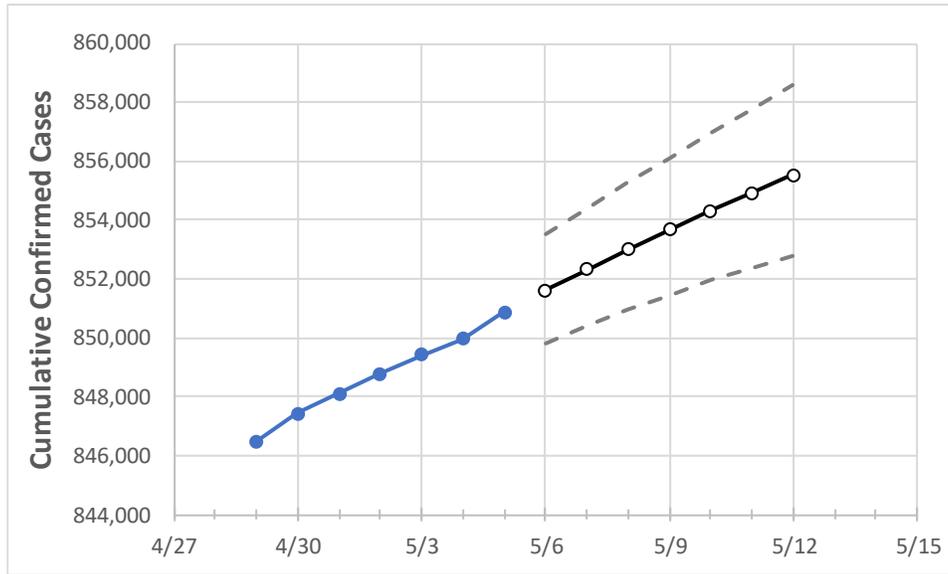
IEM's Modeling Lead

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:						
	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12
Tennessee	848,767	849,436	849,978	850,885	851,630	852,331	853,007	853,663	854,308	854,924	855,536

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:						
	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12
Blount	15,419	15,434	15,441	15,468	15,486	15,504	15,523	15,542	15,560	15,578	15,596
Davidson	89,077	89,143	89,184	89,250	89,305	89,357	89,407	89,455	89,501	89,547	89,590
Hamilton	44,039	44,078	44,114	44,186	44,231	44,275	44,320	44,365	44,409	44,452	44,496
Knox	50,449	50,489	50,513	50,562	50,600	50,636	50,672	50,708	50,741	50,774	50,806
Rutherford	42,887	42,925	42,950	42,989	43,021	43,052	43,084	43,115	43,143	43,171	43,199
Shelby	94,988	95,106	95,208	95,375	95,511	95,645	95,780	95,911	96,041	96,170	96,297
Sumner	23,884	23,910	23,921	23,951	23,975	23,998	24,020	24,043	24,064	24,086	24,107
Williamson	27,891	27,914	27,935	27,959	27,980	28,001	28,022	28,042	28,061	28,079	28,097

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:											
	5/2	5/3	5/4	5/5	5/7			5/9			5/11					
Blount	15,419	15,434	15,441	15,468	15,504	(3,101)	[744]	{372}	15,542	(3,108)	[746]	{373}	15,578	(3,116)	[748]	{374}
Davidson	89,077	89,143	89,184	89,250	89,357	(17,871)	[4,289]	{2,145}	89,455	(17,891)	[4,294]	{2,147}	89,547	(17,909)	[4,298]	{2,149}
Hamilton	44,039	44,078	44,114	44,186	44,275	(8,855)	[2,125]	{1,063}	44,365	(8,873)	[2,130]	{1,065}	44,452	(8,890)	[2,134]	{1,067}
Knox	50,449	50,489	50,513	50,562	50,636	(10,127)	[2,431]	{1,215}	50,708	(10,142)	[2,434]	{1,217}	50,774	(10,155)	[2,437]	{1,219}
Rutherford	42,887	42,925	42,950	42,989	43,052	(8,610)	[2,067]	{1,033}	43,115	(8,623)	[2,070]	{1,035}	43,171	(8,634)	[2,072]	{1,036}
Shelby	94,988	95,106	95,208	95,375	95,645	(19,129)	[4,591]	{2,295}	95,911	(19,182)	[4,604]	{2,302}	96,170	(19,234)	[4,616]	{2,308}
Sumner	23,884	23,910	23,921	23,951	23,998	(4,800)	[1,152]	{576}	24,043	(4,809)	[1,154]	{577}	24,086	(4,817)	[1,156]	{578}
Williamson	27,891	27,914	27,935	27,959	28,001	(5,600)	[1,344]	{672}	28,042	(5,608)	[1,346]	{673}	28,079	(5,616)	[1,348]	{674}

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.