

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

Date: 5/25/21

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 5/25/21 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.

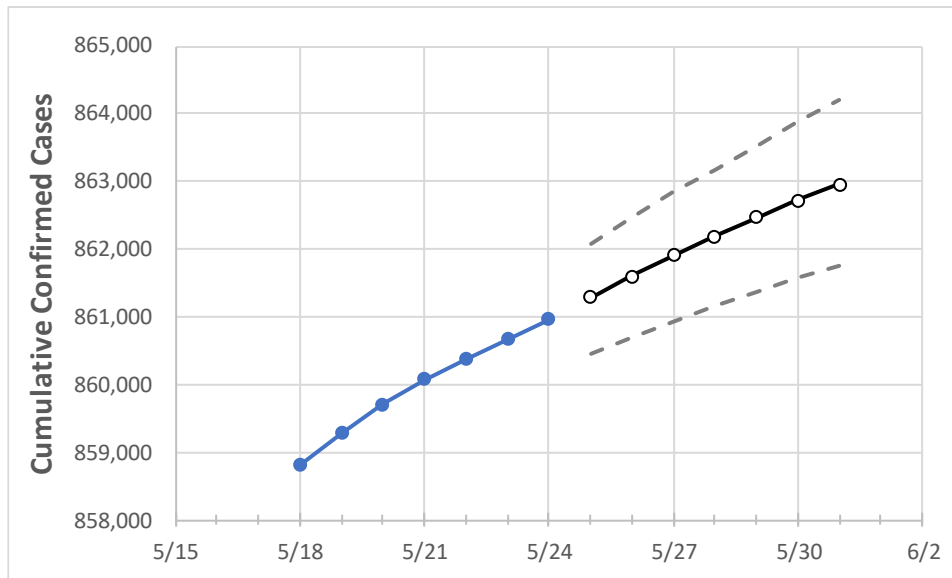
IEM's Modeling Lead

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Tennessee	860,084	860,378	860,672	860,966	861,292	861,605	861,906	862,190	862,464	862,721	862,964

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Blount	15,600	15,603	15,606	15,609	15,614	15,619	15,623	15,627	15,631	15,636	15,639
Davidson	89,940	89,964	89,988	90,012	90,042	90,070	90,098	90,125	90,151	90,176	90,201
Hamilton	44,785	44,804	44,824	44,843	44,869	44,895	44,920	44,943	44,968	44,992	45,014
Knox	51,345	51,359	51,372	51,386	51,422	51,456	51,491	51,526	51,558	51,591	51,623
Rutherford	43,358	43,372	43,387	43,401	43,418	43,433	43,448	43,462	43,476	43,490	43,503
Shelby	97,076	97,149	97,222	97,295	97,371	97,447	97,520	97,594	97,663	97,731	97,797
Sumner	24,233	24,241	24,249	24,257	24,267	24,277	24,287	24,296	24,304	24,313	24,321
Williamson	28,204	28,211	28,218	28,225	28,234	28,244	28,253	28,262	28,270	28,278	28,286

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:											
	5/21	5/22	5/23	5/24	5/26			5/28			5/30					
Blount	15,600	15,603	15,606	15,609	15,619	(3,124)	[750]	{375}	15,627	(3,125)	[750]	{375}	15,636	(3,127)	[751]	{375}
Davidson	89,940	89,964	89,988	90,012	90,070	(18,014)	[4,323]	{2,162}	90,125	(18,025)	[4,326]	{2,163}	90,176	(18,035)	[4,328]	{2,164}
Hamilton	44,785	44,804	44,824	44,843	44,895	(8,979)	[2,155]	{1,077}	44,943	(8,989)	[2,157]	{1,079}	44,992	(8,998)	[2,160]	{1,080}
Knox	51,345	51,359	51,372	51,386	51,456	(10,291)	[2,470]	{1,235}	51,526	(10,305)	[2,473]	{1,237}	51,591	(10,318)	[2,476]	{1,238}
Rutherford	43,358	43,372	43,387	43,401	43,433	(8,687)	[2,085]	{1,042}	43,462	(8,692)	[2,086]	{1,043}	43,490	(8,698)	[2,088]	{1,044}
Shelby	97,076	97,149	97,222	97,295	97,447	(19,489)	[4,677]	{2,339}	97,594	(19,519)	[4,685]	{2,342}	97,731	(19,546)	[4,691]	{2,346}
Sumner	24,233	24,241	24,249	24,257	24,277	(4,855)	[1,165]	{583}	24,296	(4,859)	[1,166]	{583}	24,313	(4,863)	[1,167]	{584}
Williamson	28,204	28,211	28,218	28,225	28,244	(5,649)	[1,356]	{678}	28,262	(5,652)	[1,357]	{678}	28,278	(5,656)	[1,357]	{679}

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.