

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

Date: 1/26/21

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 1/26/21 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.

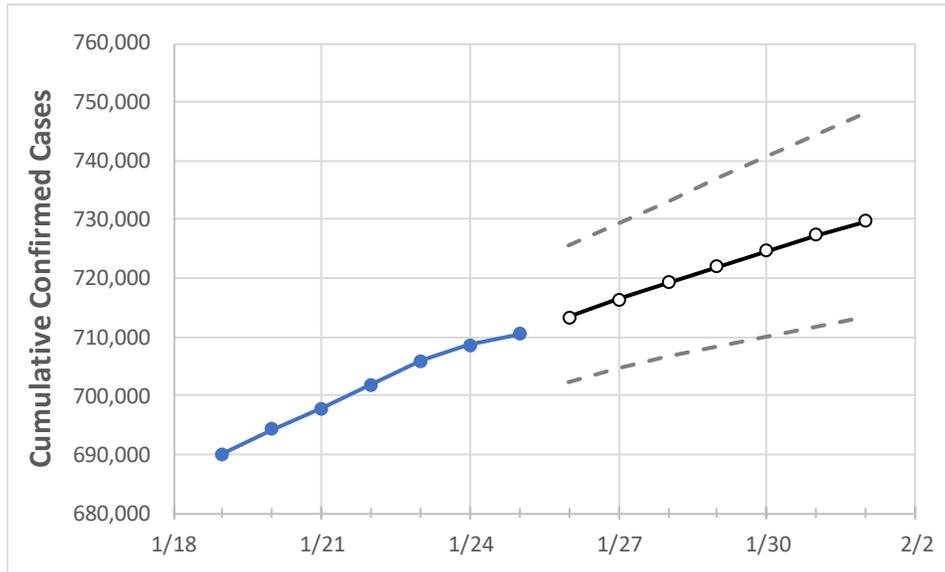
IEM's Modeling Lead

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Tennessee	701,847	705,876	708,717	710,427	713,432	716,371	719,210	721,930	724,650	727,296	729,714

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Blount	12,267	12,321	12,366	12,382	12,450	12,517	12,584	12,642	12,706	12,767	12,824
Davidson	72,385	72,746	73,045	73,248	73,581	73,908	74,221	74,534	74,840	75,131	75,415
Hamilton	35,466	35,697	35,861	35,983	36,157	36,322	36,488	36,643	36,794	36,939	37,081
Knox	39,701	39,988	40,173	40,335	40,532	40,729	40,916	41,101	41,276	41,445	41,611
Rutherford	33,860	34,042	34,166	34,271	34,413	34,553	34,688	34,816	34,941	35,060	35,183
Shelby	77,971	78,387	78,795	79,025	79,371	79,710	80,041	80,359	80,669	80,984	81,285
Sumner	18,644	18,744	18,819	18,862	18,943	19,022	19,097	19,171	19,243	19,312	19,381
Williamson	21,906	22,041	22,175	22,259	22,361	22,462	22,560	22,654	22,749	22,835	22,919

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:											
	1/22	1/23	1/24	1/25	1/27				1/29				1/31			
Blount	12,267	12,321	12,366	12,382	12,517	(2,503)	[601]	{300}	12,642	(2,528)	[607]	{303}	12,767	(2,553)	[613]	{306}
Davidson	72,385	72,746	73,045	73,248	73,908	(14,782)	[3,548]	{1,774}	74,534	(14,907)	[3,578]	{1,789}	75,131	(15,026)	[3,606]	{1,803}
Hamilton	35,466	35,697	35,861	35,983	36,322	(7,264)	[1,743]	{872}	36,643	(7,329)	[1,759]	{879}	36,939	(7,388)	[1,773]	{887}
Knox	39,701	39,988	40,173	40,335	40,729	(8,146)	[1,955]	{977}	41,101	(8,220)	[1,973]	{986}	41,445	(8,289)	[1,989]	{995}
Rutherford	33,860	34,042	34,166	34,271	34,553	(6,911)	[1,659]	{829}	34,816	(6,963)	[1,671]	{836}	35,060	(7,012)	[1,683]	{841}
Shelby	77,971	78,387	78,795	79,025	79,710	(15,942)	[3,826]	{1,913}	80,359	(16,072)	[3,857]	{1,929}	80,984	(16,197)	[3,887]	{1,944}
Sumner	18,644	18,744	18,819	18,862	19,022	(3,804)	[913]	{457}	19,171	(3,834)	[920]	{460}	19,312	(3,862)	[927]	{463}
Williamson	21,906	22,041	22,175	22,259	22,462	(4,492)	[1,078]	{539}	22,654	(4,531)	[1,087]	{544}	22,835	(4,567)	[1,096]	{548}

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.