

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

Date: 12/18/20

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 12/18/20 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.

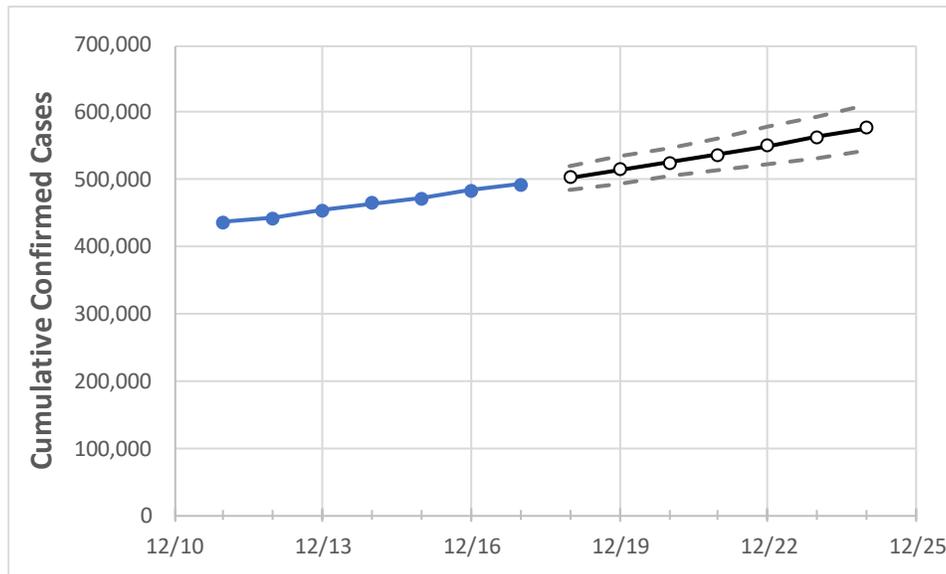
IEM's Modeling Lead

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:							
	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	
Tennessee	464,624	472,875	484,285	493,230	503,614	514,480	525,846	537,731	550,153	563,133	576,691	

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 20%, and are often within 10%, of actual confirmed cases.

Tennessee Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	
Blount	7,534	7,610	7,823	7,982	8,145	8,313	8,485	8,663	8,845	9,033	9,225	
Davidson	50,898	51,549	52,439	53,221	54,042	54,900	55,795	56,729	57,703	58,718	59,777	
Hamilton	21,535	21,969	22,532	23,126	23,654	24,213	24,803	25,427	26,085	26,781	27,514	
Knox	24,944	25,478	26,179	26,658	27,266	27,899	28,559	29,246	29,961	30,706	31,480	
Rutherford	22,904	23,272	23,828	24,221	24,733	25,268	25,825	26,407	27,013	27,644	28,301	
Shelby	56,311	56,987	58,127	58,757	59,569	60,411	61,283	62,188	63,125	64,096	65,102	
Sumner	12,762	12,925	13,216	13,383	13,627	13,877	14,134	14,398	14,669	14,946	15,231	
Williamson	14,002	14,232	14,557	14,786	15,023	15,266	15,518	15,776	16,043	16,317	16,599	

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:											
	12/14	12/15	12/16	12/17	12/19				12/21				12/23			
Blount	7,534	7,610	7,823	7,982	8,313	(1,663)	[399]	{200}	8,663	(1,733)	[416]	{208}	9,033	(1,807)	[434]	{217}
Davidson	50,898	51,549	52,439	53,221	54,900	(10,980)	[2,635]	{1,318}	56,729	(11,346)	[2,723]	{1,361}	58,718	(11,744)	[2,818]	{1,409}
Hamilton	21,535	21,969	22,532	23,126	24,213	(4,843)	[1,162]	{581}	25,427	(5,085)	[1,220]	{610}	26,781	(5,356)	[1,285]	{643}
Knox	24,944	25,478	26,179	26,658	27,899	(5,580)	[1,339]	{670}	29,246	(5,849)	[1,404]	{702}	30,706	(6,141)	[1,474]	{737}
Rutherford	22,904	23,272	23,828	24,221	25,268	(5,054)	[1,213]	{606}	26,407	(5,281)	[1,268]	{634}	27,644	(5,529)	[1,327]	{663}
Shelby	56,311	56,987	58,127	58,757	60,411	(12,082)	[2,900]	{1,450}	62,188	(12,438)	[2,985]	{1,493}	64,096	(12,819)	[3,077]	{1,538}
Sumner	12,762	12,925	13,216	13,383	13,877	(2,775)	[666]	{333}	14,398	(2,880)	[691]	{346}	14,946	(2,989)	[717]	{359}
Williamson	14,002	14,232	14,557	14,786	15,266	(3,053)	[733]	{366}	15,776	(3,155)	[757]	{379}	16,317	(3,263)	[783]	{392}

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.