

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

Date: 1/13/21

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 1/13/21 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.

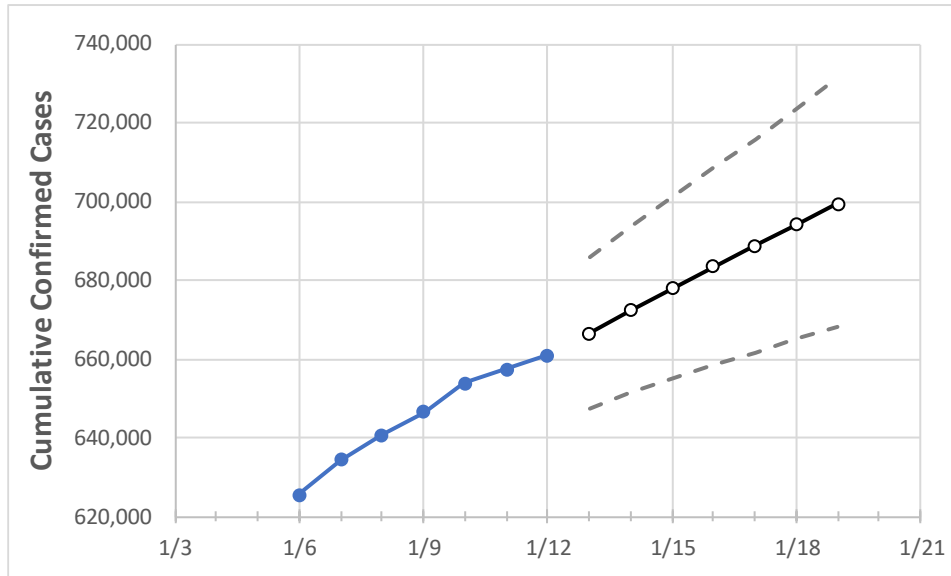
IEM's Modeling Lead

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:						
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19
Tennessee	646,450	653,869	657,396	660,874	666,562	672,230	677,913	683,527	688,849	694,225	699,531

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:						
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19
Blount	11,013	11,127	11,203	11,245	11,340	11,439	11,538	11,635	11,732	11,823	11,915
Davidson	66,901	67,645	67,992	68,292	68,814	69,346	69,874	70,387	70,915	71,412	71,932
Hamilton	32,082	32,446	32,715	33,011	33,388	33,758	34,125	34,490	34,862	35,239	35,608
Knox	36,306	36,717	36,973	37,197	37,551	37,908	38,252	38,589	38,935	39,264	39,597
Rutherford	31,214	31,563	31,744	31,972	32,234	32,494	32,749	32,999	33,244	33,499	33,744
Shelby	72,183	72,840	73,322	73,749	74,302	74,839	75,374	75,910	76,451	77,009	77,555
Sumner	17,243	17,405	17,473	17,584	17,718	17,854	17,989	18,121	18,248	18,376	18,504
Williamson	20,063	20,319	20,470	20,592	20,802	21,013	21,225	21,435	21,641	21,849	22,058

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:											
	1/9	1/10	1/11	1/12	1/14				1/16				1/18			
Blount	11,013	11,127	11,203	11,245	11,439	(2,288)	[549]	{275}	11,635	(2,327)	[558]	{279}	11,823	(2,365)	[568]	{284}
Davidson	66,901	67,645	67,992	68,292	69,346	(13,869)	[3,329]	{1,664}	70,387	(14,077)	[3,379]	{1,689}	71,412	(14,282)	[3,428]	{1,714}
Hamilton	32,082	32,446	32,715	33,011	33,758	(6,752)	[1,620]	{810}	34,490	(6,898)	[1,656]	{828}	35,239	(7,048)	[1,691]	{846}
Knox	36,306	36,717	36,973	37,197	37,908	(7,582)	[1,820]	{910}	38,589	(7,718)	[1,852]	{926}	39,264	(7,853)	[1,885]	{942}
Rutherford	31,214	31,563	31,744	31,972	32,494	(6,499)	[1,560]	{780}	32,999	(6,600)	[1,584]	{792}	33,499	(6,700)	[1,608]	{804}
Shelby	72,183	72,840	73,322	73,749	74,839	(14,968)	[3,592]	{1,796}	75,910	(15,182)	[3,644]	{1,822}	77,009	(15,402)	[3,696]	{1,848}
Sumner	17,243	17,405	17,473	17,584	17,854	(3,571)	[857]	{429}	18,121	(3,624)	[870]	{435}	18,376	(3,675)	[882]	{441}
Williamson	20,063	20,319	20,470	20,592	21,013	(4,203)	[1,009]	{504}	21,435	(4,287)	[1,029]	{514}	21,849	(4,370)	[1,049]	{524}

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.