

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

**Date: 2/17/21**

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 2/17/21 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.**

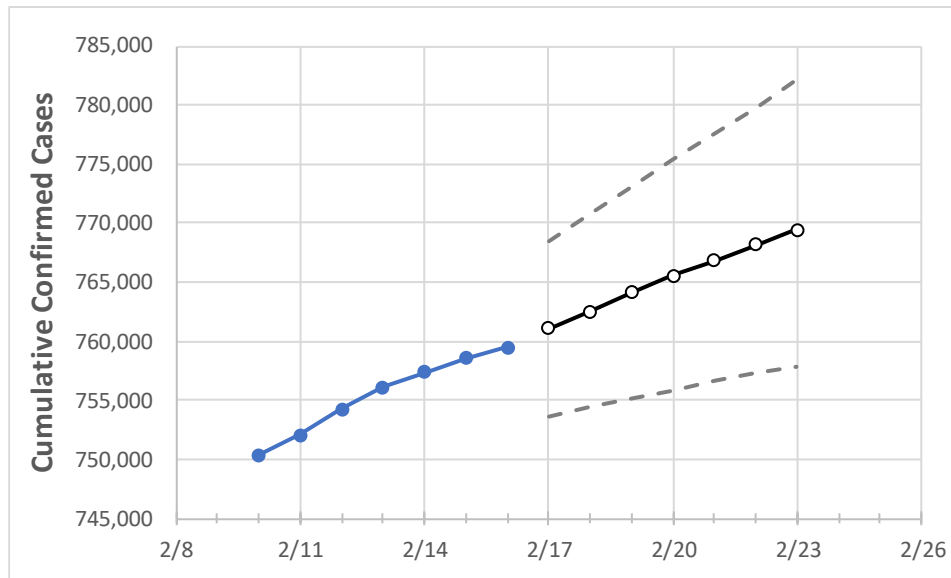
### **IEM's Modeling Lead**

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
Tennessee	756,071	757,418	758,561	759,523	761,057	762,567	764,107	765,530	766,872	768,168	769,489

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
Blount	13,611	13,655	13,695	13,738	13,827	13,914	14,008	14,104	14,201	14,306	14,411
Davidson	78,756	79,178	79,542	79,851	80,250	80,663	81,075	81,508	81,962	82,421	82,884
Hamilton	38,851	38,925	39,044	39,152	39,250	39,344	39,434	39,524	39,610	39,693	39,772
Knox	43,689	43,947	44,168	44,340	44,531	44,724	44,918	45,112	45,306	45,501	45,701
Rutherford	36,863	37,063	37,217	37,335	37,502	37,670	37,841	38,016	38,194	38,374	38,559
Shelby	84,642	85,092	85,474	85,775	86,144	86,519	86,899	87,280	87,655	88,049	88,434
Sumner	20,789	20,843	20,884	20,912	21,030	21,147	21,273	21,402	21,532	21,667	21,806
Williamson	24,395	24,477	24,549	24,612	24,705	24,795	24,885	24,975	25,063	25,151	25,240

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:											
	2/13	2/14	2/15	2/16	2/18				2/20				2/22			
Blount	13,611	13,655	13,695	13,738	13,914	(2,783)	[668]	{334}	14,104	(2,821)	[677]	{338}	14,306	(2,861)	[687]	{343}
Davidson	78,756	79,178	79,542	79,851	80,663	(16,133)	[3,872]	{1,936}	81,508	(16,302)	[3,912]	{1,956}	82,421	(16,484)	[3,956]	{1,978}
Hamilton	38,851	38,925	39,044	39,152	39,344	(7,869)	[1,888]	{944}	39,524	(7,905)	[1,897]	{949}	39,693	(7,939)	[1,905]	{953}
Knox	43,689	43,947	44,168	44,340	44,724	(8,945)	[2,147]	{1,073}	45,112	(9,022)	[2,165]	{1,083}	45,501	(9,100)	[2,184]	{1,092}
Rutherford	36,863	37,063	37,217	37,335	37,670	(7,534)	[1,808]	{904}	38,016	(7,603)	[1,825]	{912}	38,374	(7,675)	[1,842]	{921}
Shelby	84,642	85,092	85,474	85,775	86,519	(17,304)	[4,153]	{2,076}	87,280	(17,456)	[4,189]	{2,095}	88,049	(17,610)	[4,226]	{2,113}
Sumner	20,789	20,843	20,884	20,912	21,147	(4,229)	[1,015]	{508}	21,402	(4,280)	[1,027]	{514}	21,667	(4,333)	[1,040]	{520}
Williamson	24,395	24,477	24,549	24,612	24,795	(4,959)	[1,190]	{595}	24,975	(4,995)	[1,199]	{599}	25,151	(5,030)	[1,207]	{604}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.