

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 12/10/20**

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 12/10/20 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.**

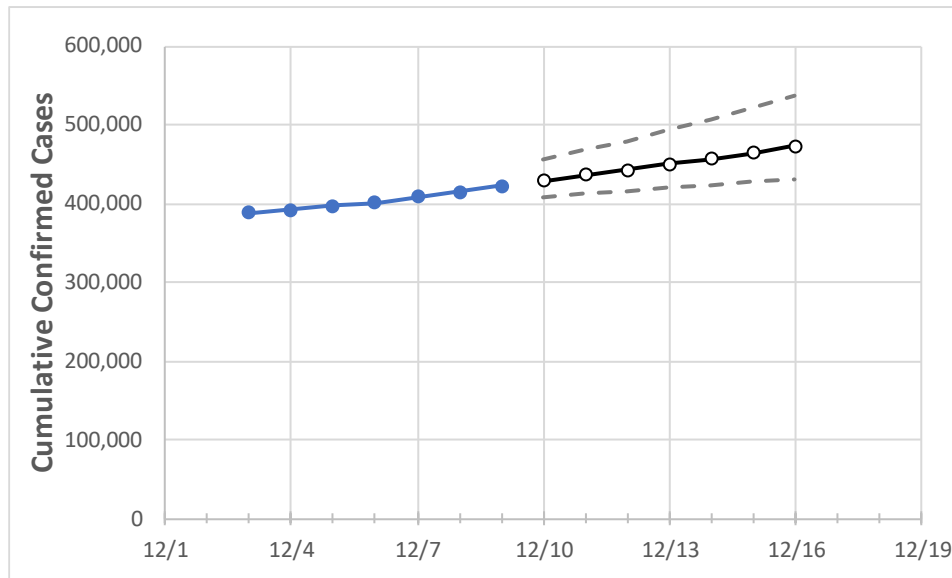
**IEM's Modeling Lead**

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Tennessee	400,594	408,730	414,749	422,962	429,311	435,895	442,717	449,787	457,111	464,696	472,551

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Blount	6,377	6,559	6,669	6,821	6,956	7,096	7,241	7,393	7,550	7,714	7,885
Davidson	45,923	46,491	46,929	47,595	48,114	48,653	49,213	49,796	50,402	51,032	51,686
Hamilton	18,824	19,107	19,417	19,729	20,053	20,390	20,741	21,106	21,486	21,881	22,293
Knox	21,218	21,696	22,084	22,491	22,914	23,356	23,818	24,299	24,802	25,326	25,873
Rutherford	19,594	20,061	20,346	20,721	21,054	21,403	21,766	22,146	22,542	22,956	23,387
Shelby	51,030	51,550	52,068	52,722	53,284	53,865	54,465	55,084	55,723	56,383	57,064
Sumner	10,928	11,148	11,380	11,558	11,726	11,898	12,074	12,254	12,438	12,627	12,820
Williamson	12,426	12,638	12,804	12,996	13,153	13,313	13,476	13,642	13,810	13,981	14,155

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:											
	12/6	12/7	12/8	12/9	12/11				12/13				12/15			
Blount	6,377	6,559	6,669	6,821	7,096	(1,419)	[341]	{170}	7,393	(1,479)	[355]	{177}	7,714	(1,543)	[370]	{185}
Davidson	45,923	46,491	46,929	47,595	48,653	(9,731)	[2,335]	{1,168}	49,796	(9,959)	[2,390]	{1,195}	51,032	(10,206)	[2,450]	{1,225}
Hamilton	18,824	19,107	19,417	19,729	20,390	(4,078)	[979]	{489}	21,106	(4,221)	[1,013]	{507}	21,881	(4,376)	[1,050]	{525}
Knox	21,218	21,696	22,084	22,491	23,356	(4,671)	[1,121]	{561}	24,299	(4,860)	[1,166]	{583}	25,326	(5,065)	[1,216]	{608}
Rutherford	19,594	20,061	20,346	20,721	21,403	(4,281)	[1,027]	{514}	22,146	(4,429)	[1,063]	{532}	22,956	(4,591)	[1,102]	{551}
Shelby	51,030	51,550	52,068	52,722	53,865	(10,773)	[2,586]	{1,293}	55,084	(11,017)	[2,644]	{1,322}	56,383	(11,277)	[2,706]	{1,353}
Sumner	10,928	11,148	11,380	11,558	11,898	(2,380)	[571]	{286}	12,254	(2,451)	[588]	{294}	12,627	(2,525)	[606]	{303}
Williamson	12,426	12,638	12,804	12,996	13,313	(2,663)	[639]	{320}	13,642	(2,728)	[655]	{327}	13,981	(2,796)	[671]	{336}

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.