

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

Date: 1/19/21

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 1/19/21 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.**

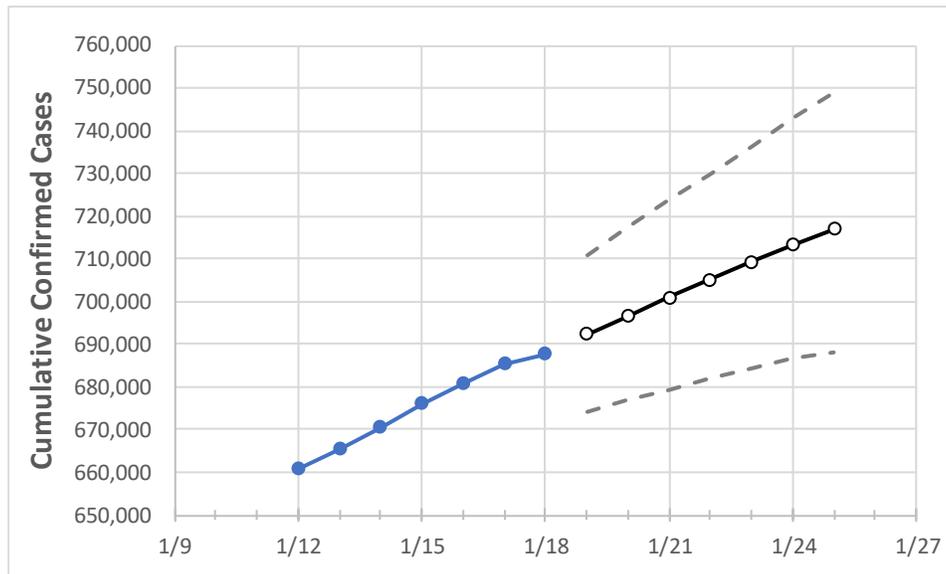
### IEM's Modeling Lead

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Tennessee	676,039	680,847	685,321	687,751	692,299	696,648	700,927	705,089	709,332	713,255	717,012

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Blount	11,708	11,784	11,887	11,914	12,005	12,100	12,195	12,292	12,382	12,474	12,566
Davidson	69,679	70,180	70,706	70,950	71,428	71,878	72,347	72,795	73,238	73,656	74,084
Hamilton	34,075	34,288	34,556	34,687	34,962	35,224	35,489	35,745	35,992	36,235	36,469
Knox	38,097	38,327	38,646	38,829	39,109	39,387	39,659	39,913	40,176	40,425	40,674
Rutherford	32,696	32,907	33,114	33,228	33,454	33,677	33,890	34,108	34,325	34,534	34,744
Shelby	75,260	75,747	76,167	76,519	76,969	77,409	77,840	78,256	78,662	79,062	79,453
Sumner	17,980	18,067	18,205	18,262	18,370	18,480	18,586	18,688	18,792	18,894	18,992
Williamson	21,054	21,226	21,364	21,449	21,592	21,729	21,863	21,995	22,124	22,247	22,368

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:											
	1/15	1/16	1/17	1/18	1/20				1/22				1/24			
Blount	11,708	11,784	11,887	11,914	12,100	(2,420)	[581]	{290}	12,292	(2,458)	[590]	{295}	12,474	(2,495)	[599]	{299}
Davidson	69,679	70,180	70,706	70,950	71,878	(14,376)	[3,450]	{1,725}	72,795	(14,559)	[3,494]	{1,747}	73,656	(14,731)	[3,536]	{1,768}
Hamilton	34,075	34,288	34,556	34,687	35,224	(7,045)	[1,691]	{845}	35,745	(7,149)	[1,716]	{858}	36,235	(7,247)	[1,739]	{870}
Knox	38,097	38,327	38,646	38,829	39,387	(7,877)	[1,891]	{945}	39,913	(7,983)	[1,916]	{958}	40,425	(8,085)	[1,940]	{970}
Rutherford	32,696	32,907	33,114	33,228	33,677	(6,735)	[1,616]	{808}	34,108	(6,822)	[1,637]	{819}	34,534	(6,907)	[1,658]	{829}
Shelby	75,260	75,747	76,167	76,519	77,409	(15,482)	[3,716]	{1,858}	78,256	(15,651)	[3,756]	{1,878}	79,062	(15,812)	[3,795]	{1,897}
Sumner	17,980	18,067	18,205	18,262	18,480	(3,696)	[887]	{444}	18,688	(3,738)	[897]	{449}	18,894	(3,779)	[907]	{453}
Williamson	21,054	21,226	21,364	21,449	21,729	(4,346)	[1,043]	{522}	21,995	(4,399)	[1,056]	{528}	22,247	(4,449)	[1,068]	{534}

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.