

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

Date: 4/12/21

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 4/12/21 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.**

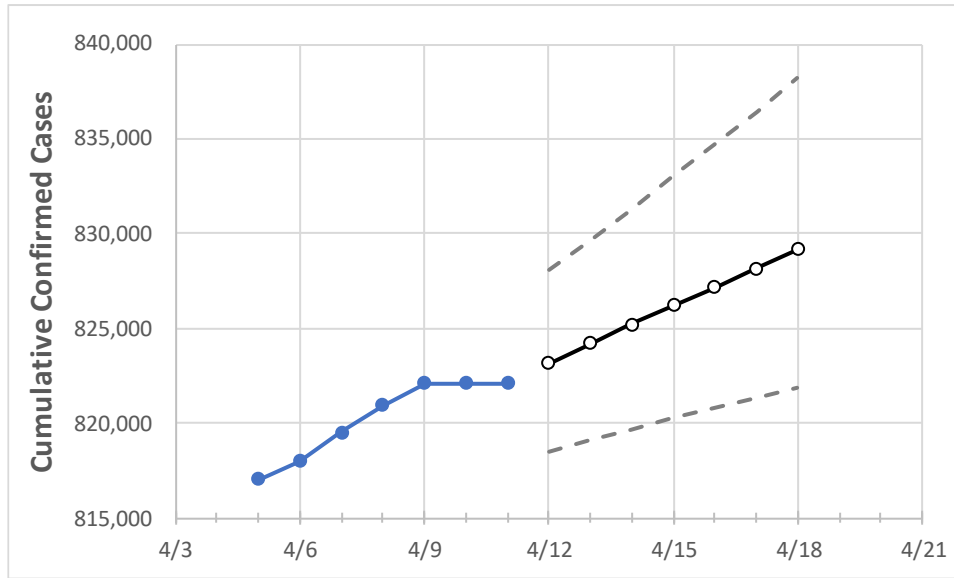
### IEM's Modeling Lead

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:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
Tennessee	820,965	822,085	822,085	822,085	823,132	824,200	825,192	826,211	827,175	828,179	829,173

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:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
Blount	14,822	14,839	14,839	14,839	14,852	14,865	14,878	14,892	14,905	14,918	14,930
Davidson	86,477	86,563	86,563	86,563	86,675	86,783	86,895	87,006	87,116	87,228	87,337
Hamilton	42,754	42,811	42,811	42,811	42,859	42,907	42,955	43,002	43,049	43,095	43,141
Knox	48,915	48,960	48,960	48,960	49,016	49,069	49,121	49,174	49,225	49,276	49,325
Rutherford	41,366	41,428	41,428	41,428	41,487	41,546	41,603	41,657	41,712	41,768	41,821
Shelby	91,338	91,497	91,497	91,497	91,611	91,723	91,841	91,955	92,075	92,197	92,316
Sumner	22,880	22,909	22,909	22,909	22,947	22,985	23,023	23,063	23,101	23,138	23,174
Williamson	26,912	26,942	26,942	26,942	26,974	27,005	27,036	27,067	27,097	27,126	27,155

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:											
	4/8	4/9	4/10	4/11	4/13				4/15				4/17			
Blount	14,822	14,839	14,839	14,839	14,865	(2,973)	[714]	{357}	14,892	(2,978)	[715]	{357}	14,918	(2,984)	[716]	{358}
Davidson	86,477	86,563	86,563	86,563	86,783	(17,357)	[4,166]	{2,083}	87,006	(17,401)	[4,176]	{2,088}	87,228	(17,446)	[4,187]	{2,093}
Hamilton	42,754	42,811	42,811	42,811	42,907	(8,581)	[2,060]	{1,030}	43,002	(8,600)	[2,064]	{1,032}	43,095	(8,619)	[2,069]	{1,034}
Knox	48,915	48,960	48,960	48,960	49,069	(9,814)	[2,355]	{1,178}	49,174	(9,835)	[2,360]	{1,180}	49,276	(9,855)	[2,365]	{1,183}
Rutherford	41,366	41,428	41,428	41,428	41,546	(8,309)	[1,994]	{997}	41,657	(8,331)	[2,000]	{1,000}	41,768	(8,354)	[2,005]	{1,002}
Shelby	91,338	91,497	91,497	91,497	91,723	(18,345)	[4,403]	{2,201}	91,955	(18,391)	[4,414]	{2,207}	92,197	(18,439)	[4,425]	{2,213}
Sumner	22,880	22,909	22,909	22,909	22,985	(4,597)	[1,103]	{552}	23,063	(4,613)	[1,107]	{554}	23,138	(4,628)	[1,111]	{555}
Williamson	26,912	26,942	26,942	26,942	27,005	(5,401)	[1,296]	{648}	27,067	(5,413)	[1,299]	{650}	27,126	(5,425)	[1,302]	{651}

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.