

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

Date: 4/14/21

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 4/14/21 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.**

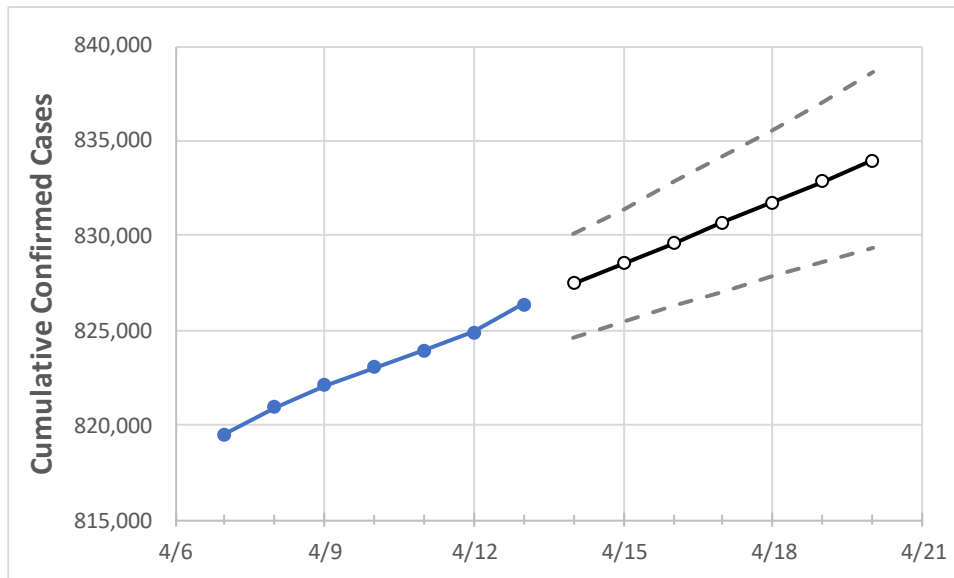
### IEM's Modeling Lead

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:						
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20
Tennessee	823,028	823,971	824,914	826,371	827,464	828,537	829,614	830,699	831,778	832,869	833,951

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:						
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20
Blount	14,853	14,868	14,882	14,894	14,907	14,919	14,932	14,944	14,956	14,968	14,980
Davidson	86,640	86,716	86,793	86,974	87,081	87,184	87,285	87,391	87,494	87,593	87,692
Hamilton	42,861	42,911	42,961	43,024	43,072	43,120	43,168	43,215	43,262	43,309	43,355
Knox	49,011	49,063	49,114	49,179	49,231	49,283	49,334	49,384	49,434	49,481	49,529
Rutherford	41,475	41,521	41,568	41,648	41,704	41,759	41,813	41,866	41,918	41,970	42,021
Shelby	91,649	91,801	91,953	92,106	92,248	92,394	92,537	92,689	92,841	93,002	93,160
Sumner	22,934	22,958	22,983	23,020	23,053	23,085	23,116	23,148	23,178	23,209	23,238
Williamson	26,973	27,005	27,036	27,085	27,118	27,150	27,182	27,213	27,244	27,273	27,302

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:											
	4/10	4/11	4/12	4/13	4/15				4/17				4/19			
Blount	14,853	14,868	14,882	14,894	14,919	(2,984)	[716]	{358}	14,944	(2,989)	[717]	{359}	14,968	(2,994)	[718]	{359}
Davidson	86,640	86,716	86,793	86,974	87,184	(17,437)	[4,185]	{2,092}	87,391	(17,478)	[4,195]	{2,097}	87,593	(17,519)	[4,204]	{2,102}
Hamilton	42,861	42,911	42,961	43,024	43,120	(8,624)	[2,070]	{1,035}	43,215	(8,643)	[2,074]	{1,037}	43,309	(8,662)	[2,079]	{1,039}
Knox	49,011	49,063	49,114	49,179	49,283	(9,857)	[2,366]	{1,183}	49,384	(9,877)	[2,370]	{1,185}	49,481	(9,896)	[2,375]	{1,188}
Rutherford	41,475	41,521	41,568	41,648	41,759	(8,352)	[2,004]	{1,002}	41,866	(8,373)	[2,010]	{1,005}	41,970	(8,394)	[2,015]	{1,007}
Shelby	91,649	91,801	91,953	92,106	92,394	(18,479)	[4,435]	{2,217}	92,689	(18,538)	[4,449]	{2,225}	93,002	(18,600)	[4,464]	{2,232}
Sumner	22,934	22,958	22,983	23,020	23,085	(4,617)	[1,108]	{554}	23,148	(4,630)	[1,111]	{556}	23,209	(4,642)	[1,114]	{557}
Williamson	26,973	27,005	27,036	27,085	27,150	(5,430)	[1,303]	{652}	27,213	(5,443)	[1,306]	{653}	27,273	(5,455)	[1,309]	{655}

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.