

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

Date: 4/27/21

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 4/27/21 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.**

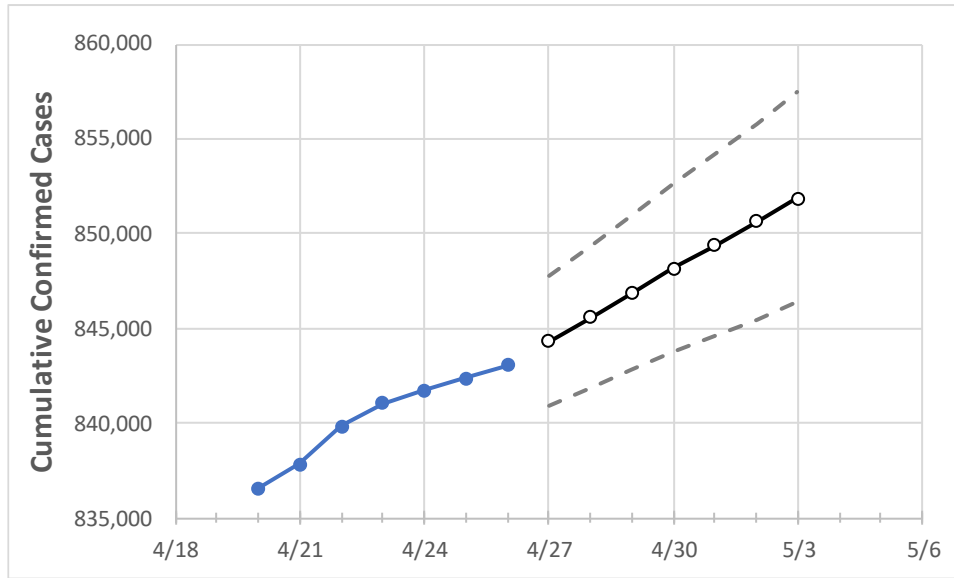
### IEM's Modeling Lead

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Tennessee	841,049	841,719	842,389	843,059	844,339	845,598	846,863	848,148	849,369	850,636	851,863

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Blount	15,249	15,263	15,278	15,292	15,320	15,348	15,377	15,408	15,437	15,468	15,498
Davidson	88,479	88,534	88,588	88,643	88,762	88,878	88,994	89,113	89,226	89,338	89,449
Hamilton	43,639	43,670	43,701	43,732	43,783	43,833	43,884	43,933	43,981	44,030	44,076
Knox	50,067	50,098	50,130	50,161	50,229	50,296	50,364	50,431	50,498	50,565	50,629
Rutherford	42,545	42,574	42,602	42,631	42,699	42,767	42,834	42,902	42,969	43,036	43,103
Shelby	93,721	93,851	93,982	94,112	94,276	94,444	94,607	94,774	94,937	95,106	95,277
Sumner	23,628	23,649	23,671	23,692	23,738	23,785	23,831	23,879	23,928	23,976	24,024
Williamson	27,663	27,685	27,708	27,730	27,773	27,817	27,863	27,906	27,950	27,995	28,040

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:											
	4/23	4/24	4/25	4/26	4/28				4/30				5/2			
Blount	15,249	15,263	15,278	15,292	15,348	(3,070)	[737]	{368}	15,408	(3,082)	[740]	{370}	15,468	(3,094)	[742]	{371}
Davidson	88,479	88,534	88,588	88,643	88,878	(17,776)	[4,266]	{2,133}	89,113	(17,823)	[4,277]	{2,139}	89,338	(17,868)	[4,288]	{2,144}
Hamilton	43,639	43,670	43,701	43,732	43,833	(8,767)	[2,104]	{1,052}	43,933	(8,787)	[2,109]	{1,054}	44,030	(8,806)	[2,113]	{1,057}
Knox	50,067	50,098	50,130	50,161	50,296	(10,059)	[2,414]	{1,207}	50,431	(10,086)	[2,421]	{1,210}	50,565	(10,113)	[2,427]	{1,214}
Rutherford	42,545	42,574	42,602	42,631	42,767	(8,553)	[2,053]	{1,026}	42,902	(8,580)	[2,059]	{1,030}	43,036	(8,607)	[2,066]	{1,033}
Shelby	93,721	93,851	93,982	94,112	94,444	(18,889)	[4,533]	{2,267}	94,774	(18,955)	[4,549]	{2,275}	95,106	(19,021)	[4,565]	{2,283}
Sumner	23,628	23,649	23,671	23,692	23,785	(4,757)	[1,142]	{571}	23,879	(4,776)	[1,146]	{573}	23,976	(4,795)	[1,151]	{575}
Williamson	27,663	27,685	27,708	27,730	27,817	(5,563)	[1,335]	{668}	27,906	(5,581)	[1,339]	{670}	27,995	(5,599)	[1,344]	{672}

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.