

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

Date: 4/23/21

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 4/23/21 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.**

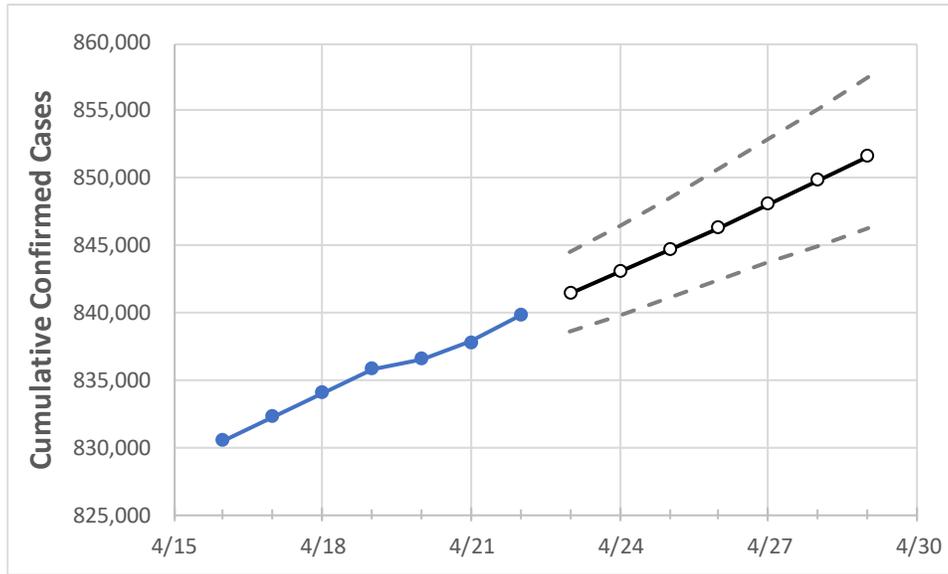
### IEM's Modeling Lead

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:						
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29
Tennessee	835,842	836,563	837,833	839,841	841,421	843,047	844,693	846,354	848,082	849,845	851,631

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:						
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29
Blount	15,180	15,194	15,213	15,240	15,276	15,313	15,352	15,392	15,433	15,476	15,522
Davidson	88,030	88,121	88,250	88,371	88,517	88,664	88,817	88,971	89,128	89,284	89,441
Hamilton	43,402	43,438	43,501	43,575	43,636	43,699	43,761	43,823	43,886	43,951	44,014
Knox	49,813	49,873	49,926	49,996	50,079	50,162	50,248	50,334	50,420	50,506	50,598
Rutherford	42,319	42,361	42,422	42,477	42,559	42,639	42,722	42,806	42,891	42,978	43,064
Shelby	93,085	93,186	93,342	93,547	93,723	93,902	94,086	94,273	94,469	94,667	94,868
Sumner	23,492	23,515	23,549	23,591	23,646	23,703	23,761	23,820	23,879	23,943	24,005
Williamson	27,545	27,569	27,589	27,637	27,692	27,749	27,803	27,862	27,923	27,986	28,047

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:											
	4/19	4/20	4/21	4/22	4/24				4/26				4/28			
Blount	15,180	15,194	15,213	15,240	15,313	(3,063)	[735]	{368}	15,392	(3,078)	[739]	{369}	15,476	(3,095)	[743]	{371}
Davidson	88,030	88,121	88,250	88,371	88,664	(17,733)	[4,256]	{2,128}	88,971	(17,794)	[4,271]	{2,135}	89,284	(17,857)	[4,286]	{2,143}
Hamilton	43,402	43,438	43,501	43,575	43,699	(8,740)	[2,098]	{1,049}	43,823	(8,765)	[2,104]	{1,052}	43,951	(8,790)	[2,110]	{1,055}
Knox	49,813	49,873	49,926	49,996	50,162	(10,032)	[2,408]	{1,204}	50,334	(10,067)	[2,416]	{1,208}	50,506	(10,101)	[2,424]	{1,212}
Rutherford	42,319	42,361	42,422	42,477	42,639	(8,528)	[2,047]	{1,023}	42,806	(8,561)	[2,055]	{1,027}	42,978	(8,596)	[2,063]	{1,031}
Shelby	93,085	93,186	93,342	93,547	93,902	(18,780)	[4,507]	{2,254}	94,273	(18,855)	[4,525]	{2,263}	94,667	(18,933)	[4,544]	{2,272}
Sumner	23,492	23,515	23,549	23,591	23,703	(4,741)	[1,138]	{569}	23,820	(4,764)	[1,143]	{572}	23,943	(4,789)	[1,149]	{575}
Williamson	27,545	27,569	27,589	27,637	27,749	(5,550)	[1,332]	{666}	27,862	(5,572)	[1,337]	{669}	27,986	(5,597)	[1,343]	{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.