

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

Date: 10/27/21

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 10/27/21 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.**

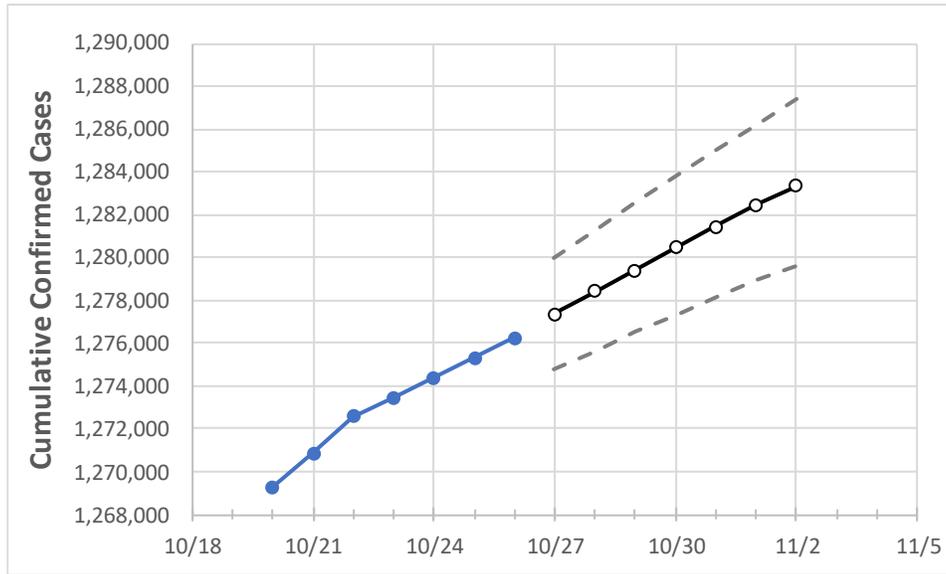
### IEM's Modeling Lead

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:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2

Tennessee 1,273,483 1,274,408 1,275,332 1,276,257 1,277,372 1,278,438 1,279,425 1,280,482 1,281,462 1,282,460 1,283,370

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:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
Blount	23,622	23,639	23,655	23,672	23,692	23,712	23,730	23,748	23,766	23,783	23,800
Davidson	120,664	120,748	120,832	120,916	121,002	121,084	121,159	121,237	121,314	121,389	121,457
Hamilton	63,334	63,382	63,429	63,476	63,543	63,606	63,669	63,731	63,792	63,854	63,913
Knox	78,242	78,306	78,371	78,435	78,517	78,596	78,675	78,752	78,825	78,900	78,970
Rutherford	61,555	61,608	61,661	61,714	61,769	61,822	61,876	61,927	61,977	62,027	62,078
Shelby	143,803	143,881	143,958	144,036	144,118	144,201	144,278	144,353	144,426	144,496	144,570
Sumner	34,113	34,139	34,164	34,189	34,220	34,251	34,281	34,310	34,339	34,368	34,395
Williamson	39,506	39,535	39,565	39,594	39,626	39,656	39,685	39,714	39,743	39,771	39,798

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:											
	10/23	10/24	10/25	10/26	10/28			10/30			11/1					
Blount	23,622	23,639	23,655	23,672	23,712	(4,742)	[1,138]	{569}	23,748	(4,750)	[1,140]	{570}	23,783	(4,757)	[1,142]	{571}
Davidson	120,664	120,748	120,832	120,916	121,084	(24,217)	[5,812]	{2,906}	121,237	(24,247)	[5,819]	{2,910}	121,389	(24,278)	[5,827]	{2,913}
Hamilton	63,334	63,382	63,429	63,476	63,606	(12,721)	[3,053]	{1,527}	63,731	(12,746)	[3,059]	{1,530}	63,854	(12,771)	[3,065]	{1,532}
Knox	78,242	78,306	78,371	78,435	78,596	(15,719)	[3,773]	{1,886}	78,752	(15,750)	[3,780]	{1,890}	78,900	(15,780)	[3,787]	{1,894}
Rutherford	61,555	61,608	61,661	61,714	61,822	(12,364)	[2,967]	{1,484}	61,927	(12,385)	[2,972]	{1,486}	62,027	(12,405)	[2,977]	{1,489}
Shelby	143,803	143,881	143,958	144,036	144,201	(28,840)	[6,922]	{3,461}	144,353	(28,871)	[6,929]	{3,464}	144,496	(28,899)	[6,936]	{3,468}
Sumner	34,113	34,139	34,164	34,189	34,251	(6,850)	[1,644]	{822}	34,310	(6,862)	[1,647]	{823}	34,368	(6,874)	[1,650]	{825}
Williamson	39,506	39,535	39,565	39,594	39,656	(7,931)	[1,903]	{952}	39,714	(7,943)	[1,906]	{953}	39,771	(7,954)	[1,909]	{955}

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.