

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 2/22/21**

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 2/22/21 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.

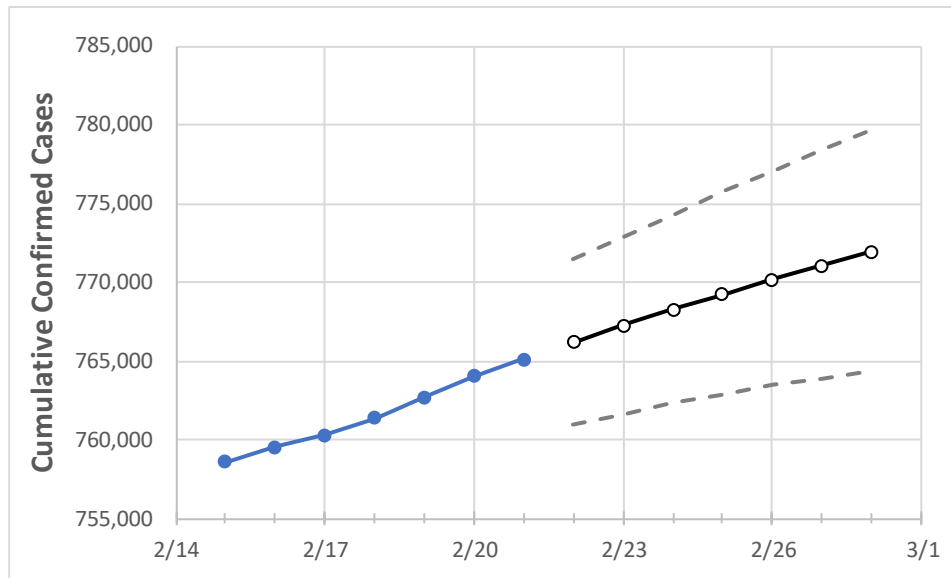
IEM's Modeling Lead

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:						
	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28
Tennessee	761,360	762,673	764,008	765,137	766,208	767,239	768,251	769,204	770,159	771,053	771,916

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:						
	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28
Blount	13,800	13,831	13,849	13,868	13,925	13,983	14,040	14,097	14,156	14,211	14,268
Davidson	80,026	80,131	80,243	80,349	80,597	80,848	81,096	81,339	81,590	81,831	82,058
Hamilton	39,420	39,565	39,675	39,728	39,821	39,915	40,004	40,092	40,178	40,263	40,343
Knox	44,614	44,759	44,876	44,982	45,135	45,287	45,442	45,597	45,749	45,902	46,048
Rutherford	37,417	37,478	37,552	37,626	37,731	37,839	37,944	38,047	38,149	38,249	38,349
Shelby	85,858	85,952	86,027	86,134	86,322	86,505	86,685	86,864	87,046	87,214	87,382
Sumner	20,964	20,994	21,030	21,064	21,135	21,206	21,279	21,355	21,432	21,507	21,579
Williamson	24,656	24,713	24,762	24,822	24,882	24,940	24,997	25,051	25,105	25,158	25,210

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:											
	2/18	2/19	2/20	2/21	2/23				2/25				2/27			
Blount	13,800	13,831	13,849	13,868	13,983	(2,797)	{671}	{336}	14,097	(2,819)	{677}	{338}	14,211	(2,842)	{682}	{341}
Davidson	80,026	80,131	80,243	80,349	80,848	(16,170)	{3,881}	{1,940}	81,339	(16,268)	{3,904}	{1,952}	81,831	(16,366)	{3,928}	{1,964}
Hamilton	39,420	39,565	39,675	39,728	39,915	(7,983)	{1,916}	{958}	40,092	(8,018)	{1,924}	{962}	40,263	(8,053)	{1,933}	{966}
Knox	44,614	44,759	44,876	44,982	45,287	(9,057)	{2,174}	{1,087}	45,597	(9,119)	{2,189}	{1,094}	45,902	(9,180)	{2,203}	{1,102}
Rutherford	37,417	37,478	37,552	37,626	37,839	(7,568)	{1,816}	{908}	38,047	(7,609)	{1,826}	{913}	38,249	(7,650)	{1,836}	{918}
Shelby	85,858	85,952	86,027	86,134	86,505	(17,301)	{4,152}	{2,076}	86,864	(17,373)	{4,169}	{2,085}	87,214	(17,443)	{4,186}	{2,093}
Sumner	20,964	20,994	21,030	21,064	21,206	(4,241)	{1,018}	{509}	21,355	(4,271)	{1,025}	{513}	21,507	(4,301)	{1,032}	{516}
Williamson	24,656	24,713	24,762	24,822	24,940	(4,988)	{1,197}	{599}	25,051	(5,010)	{1,202}	{601}	25,158	(5,032)	{1,208}	{604}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.