

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

Date: 4/22/21

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 4/22/21 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.

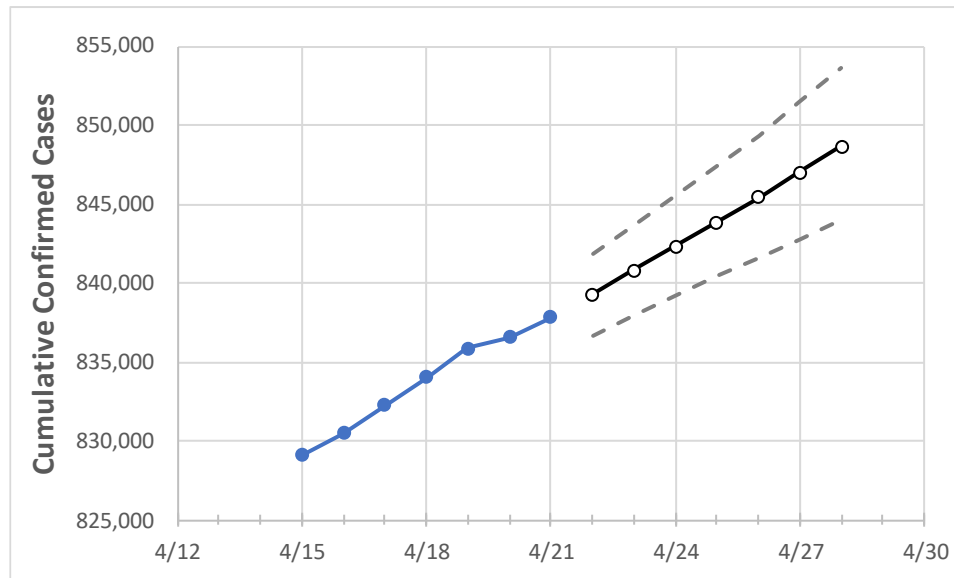
IEM's Modeling Lead

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:							
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	
Tennessee	834,056	835,842	836,563	837,833	839,305	840,781	842,303	843,845	845,415	847,004	848,633	

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:							
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	
Blount	15,108	15,180	15,194	15,213	15,250	15,289	15,328	15,369	15,412	15,458	15,505	
Davidson	87,790	88,030	88,121	88,250	88,396	88,545	88,700	88,853	89,014	89,175	89,340	
Hamilton	43,353	43,402	43,438	43,501	43,560	43,620	43,679	43,739	43,801	43,861	43,922	
Knox	49,679	49,813	49,873	49,926	50,011	50,099	50,187	50,275	50,362	50,451	50,541	
Rutherford	42,151	42,319	42,361	42,422	42,508	42,591	42,678	42,765	42,855	42,943	43,034	
Shelby	92,966	93,085	93,186	93,342	93,507	93,670	93,842	94,013	94,183	94,357	94,532	
Sumner	23,380	23,492	23,515	23,549	23,604	23,662	23,722	23,781	23,842	23,906	23,971	
Williamson	27,442	27,545	27,569	27,589	27,643	27,697	27,757	27,815	27,872	27,932	27,991	

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:											
	4/18	4/19	4/20	4/21	4/23				4/25				4/27			
Blount	15,108	15,180	15,194	15,213	15,289	(3,058)	[734]	{367}	15,369	(3,074)	[738]	{369}	15,458	(3,092)	[742]	{371}
Davidson	87,790	88,030	88,121	88,250	88,545	(17,709)	[4,250]	{2,125}	88,853	(17,771)	[4,265]	{2,132}	89,175	(17,835)	[4,280]	{2,140}
Hamilton	43,353	43,402	43,438	43,501	43,620	(8,724)	[2,094]	{1,047}	43,739	(8,748)	[2,099]	{1,050}	43,861	(8,772)	[2,105]	{1,053}
Knox	49,679	49,813	49,873	49,926	50,099	(10,020)	[2,405]	{1,202}	50,275	(10,055)	[2,413]	{1,207}	50,451	(10,090)	[2,422]	{1,211}
Rutherford	42,151	42,319	42,361	42,422	42,591	(8,518)	[2,044]	{1,022}	42,765	(8,553)	[2,053]	{1,026}	42,943	(8,589)	[2,061]	{1,031}
Shelby	92,966	93,085	93,186	93,342	93,670	(18,734)	[4,496]	{2,248}	94,013	(18,803)	[4,513]	{2,256}	94,357	(18,871)	[4,529]	{2,265}
Sumner	23,380	23,492	23,515	23,549	23,662	(4,732)	[1,136]	{568}	23,781	(4,756)	[1,141]	{571}	23,906	(4,781)	[1,147]	{574}
Williamson	27,442	27,545	27,569	27,589	27,697	(5,539)	[1,329]	{665}	27,815	(5,563)	[1,335]	{668}	27,932	(5,586)	[1,341]	{670}

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.