

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

Date: 4/8/21

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 4/8/21 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.

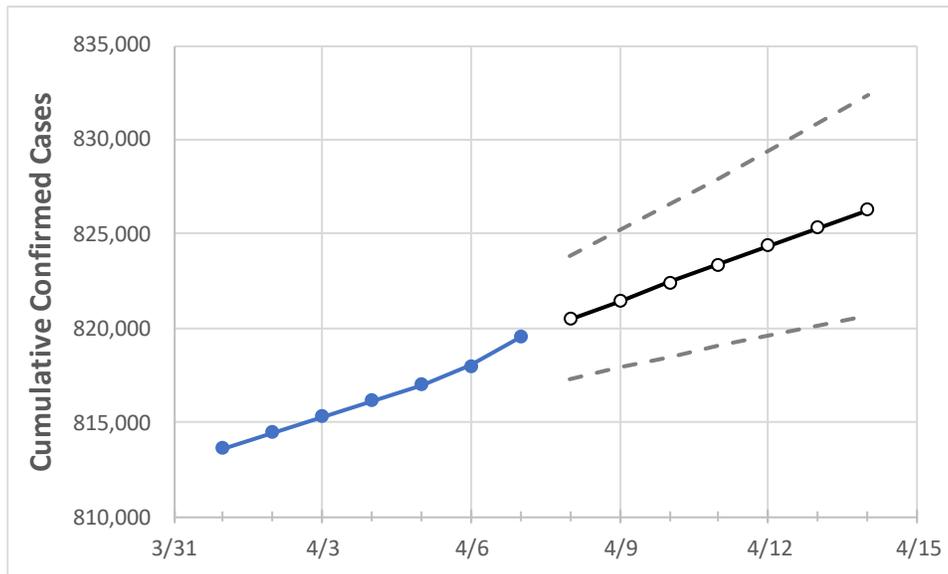
IEM's Modeling Lead

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:							
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	
Tennessee	816,170	817,022	818,008	819,505	820,475	821,425	822,405	823,385	824,373	825,337	826,267	

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:							
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	
Blount	14,751	14,762	14,770	14,798	14,808	14,818	14,828	14,837	14,847	14,857	14,866	
Davidson	85,969	86,068	86,170	86,347	86,464	86,575	86,687	86,804	86,911	87,029	87,141	
Hamilton	42,539	42,577	42,627	42,677	42,720	42,764	42,807	42,849	42,890	42,930	42,969	
Knox	48,644	48,711	48,764	48,836	48,892	48,946	48,999	49,050	49,101	49,150	49,199	
Rutherford	41,101	41,160	41,196	41,283	41,341	41,396	41,452	41,509	41,561	41,613	41,664	
Shelby	90,900	90,982	91,035	91,178	91,276	91,373	91,469	91,564	91,660	91,758	91,853	
Sumner	22,705	22,742	22,768	22,831	22,870	22,908	22,947	22,985	23,024	23,061	23,098	
Williamson	26,760	26,790	26,813	26,866	26,898	26,929	26,960	26,991	27,020	27,049	27,077	

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:											
	4/4	4/5	4/6	4/7	4/9				4/11				4/13			
Blount	14,751	14,762	14,770	14,798	14,818	(2,964)	[711]	{356}	14,837	(2,967)	[712]	{356}	14,857	(2,971)	[713]	{357}
Davidson	85,969	86,068	86,170	86,347	86,575	(17,315)	[4,156]	{2,078}	86,804	(17,361)	[4,167]	{2,083}	87,029	(17,406)	[4,177]	{2,089}
Hamilton	42,539	42,577	42,627	42,677	42,764	(8,553)	[2,053]	{1,026}	42,849	(8,570)	[2,057]	{1,028}	42,930	(8,586)	[2,061]	{1,030}
Knox	48,644	48,711	48,764	48,836	48,946	(9,789)	[2,349]	{1,175}	49,050	(9,810)	[2,354]	{1,177}	49,150	(9,830)	[2,359]	{1,180}
Rutherford	41,101	41,160	41,196	41,283	41,396	(8,279)	[1,987]	{994}	41,509	(8,302)	[1,992]	{996}	41,613	(8,323)	[1,997]	{999}
Shelby	90,900	90,982	91,035	91,178	91,373	(18,275)	[4,386]	{2,193}	91,564	(18,313)	[4,395]	{2,198}	91,758	(18,352)	[4,404]	{2,202}
Sumner	22,705	22,742	22,768	22,831	22,908	(4,582)	[1,100]	{550}	22,985	(4,597)	[1,103]	{552}	23,061	(4,612)	[1,107]	{553}
Williamson	26,760	26,790	26,813	26,866	26,929	(5,386)	[1,293]	{646}	26,991	(5,398)	[1,296]	{648}	27,049	(5,410)	[1,298]	{649}

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.