

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

Date: 4/15/21

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 4/15/21 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.

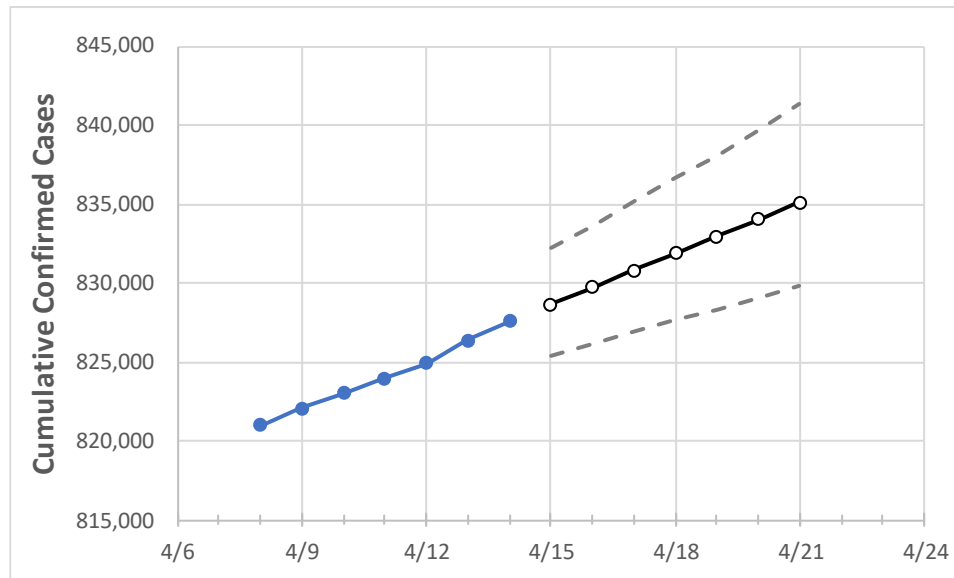
IEM's Modeling Lead

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:						
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21
Tennessee	823,971	824,914	826,371	827,579	828,654	829,744	830,811	831,882	832,958	834,030	835,080

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:						
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21
Blount	14,868	14,882	14,894	14,917	14,932	14,946	14,961	14,975	14,989	15,003	15,017
Davidson	86,716	86,793	86,974	87,087	87,193	87,297	87,401	87,502	87,600	87,698	87,797
Hamilton	42,911	42,961	43,024	43,101	43,153	43,204	43,257	43,309	43,360	43,412	43,464
Knox	49,063	49,114	49,179	49,256	49,311	49,366	49,420	49,474	49,526	49,579	49,631
Rutherford	41,521	41,568	41,648	41,703	41,756	41,809	41,860	41,911	41,962	42,011	42,059
Shelby	91,801	91,953	92,106	92,365	92,531	92,701	92,877	93,058	93,246	93,440	93,641
Sumner	22,958	22,983	23,020	23,064	23,097	23,130	23,162	23,195	23,227	23,258	23,290
Williamson	27,005	27,036	27,085	27,127	27,160	27,192	27,223	27,255	27,287	27,318	27,348

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:											
	4/11	4/12	4/13	4/14	4/16				4/18				4/20			
Blount	14,868	14,882	14,894	14,917	14,946	(2,989)	[717]	{359}	14,975	(2,995)	[719]	{359}	15,003	(3,001)	[720]	{360}
Davidson	86,716	86,793	86,974	87,087	87,297	(17,459)	[4,190]	{2,095}	87,502	(17,500)	[4,200]	{2,100}	87,698	(17,540)	[4,210]	{2,105}
Hamilton	42,911	42,961	43,024	43,101	43,204	(8,641)	[2,074]	{1,037}	43,309	(8,662)	[2,079]	{1,039}	43,412	(8,682)	[2,084]	{1,042}
Knox	49,063	49,114	49,179	49,256	49,366	(9,873)	[2,370]	{1,185}	49,474	(9,895)	[2,375]	{1,187}	49,579	(9,916)	[2,380]	{1,190}
Rutherford	41,521	41,568	41,648	41,703	41,809	(8,362)	[2,007]	{1,003}	41,911	(8,382)	[2,012]	{1,006}	42,011	(8,402)	[2,017]	{1,008}
Shelby	91,801	91,953	92,106	92,365	92,701	(18,540)	[4,450]	{2,225}	93,058	(18,612)	[4,467]	{2,233}	93,440	(18,688)	[4,485]	{2,243}
Sumner	22,958	22,983	23,020	23,064	23,130	(4,626)	[1,110]	{555}	23,195	(4,639)	[1,113]	{557}	23,258	(4,652)	[1,116]	{558}
Williamson	27,005	27,036	27,085	27,127	27,192	(5,438)	[1,305]	{653}	27,255	(5,451)	[1,308]	{654}	27,318	(5,464)	[1,311]	{656}

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.