

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

Date: 4/16/21

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 4/16/21 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.

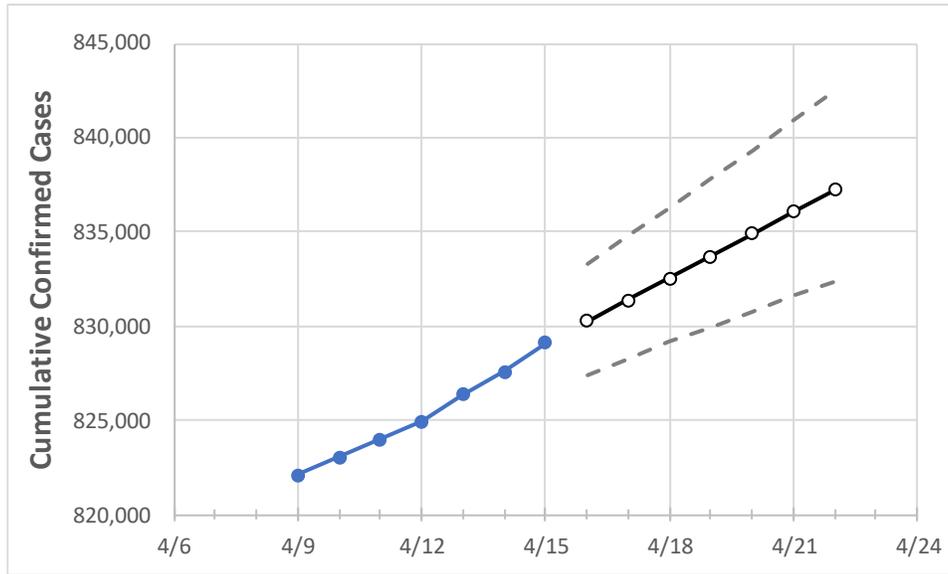
IEM's Modeling Lead

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:						
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22
Tennessee	824,914	826,371	827,579	829,114	830,258	831,402	832,557	833,711	834,898	836,089	837,243

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:						
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22
Blount	14,882	14,894	14,917	14,940	14,956	14,971	14,987	15,003	15,019	15,034	15,050
Davidson	86,793	86,974	87,087	87,182	87,284	87,384	87,486	87,584	87,684	87,783	87,880
Hamilton	42,961	43,024	43,101	43,174	43,229	43,285	43,338	43,393	43,448	43,503	43,558
Knox	49,114	49,179	49,256	49,326	49,384	49,441	49,498	49,554	49,610	49,666	49,720
Rutherford	41,568	41,648	41,703	41,760	41,814	41,866	41,919	41,969	42,019	42,068	42,116
Shelby	91,953	92,106	92,365	92,549	92,719	92,896	93,079	93,262	93,451	93,650	93,856
Sumner	22,983	23,020	23,064	23,112	23,147	23,181	23,217	23,252	23,285	23,320	23,355
Williamson	27,036	27,085	27,127	27,184	27,220	27,255	27,291	27,326	27,361	27,397	27,432

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:											
	4/12	4/13	4/14	4/15	4/17				4/19				4/21			
Blount	14,882	14,894	14,917	14,940	14,971	(2,994)	[719]	{359}	15,003	(3,001)	[720]	{360}	15,034	(3,007)	[722]	{361}
Davidson	86,793	86,974	87,087	87,182	87,384	(17,477)	[4,194]	{2,097}	87,584	(17,517)	[4,204]	{2,102}	87,783	(17,557)	[4,214]	{2,107}
Hamilton	42,961	43,024	43,101	43,174	43,285	(8,657)	[2,078]	{1,039}	43,393	(8,679)	[2,083]	{1,041}	43,503	(8,701)	[2,088]	{1,044}
Knox	49,114	49,179	49,256	49,326	49,441	(9,888)	[2,373]	{1,187}	49,554	(9,911)	[2,379]	{1,189}	49,666	(9,933)	[2,384]	{1,192}
Rutherford	41,568	41,648	41,703	41,760	41,866	(8,373)	[2,010]	{1,005}	41,969	(8,394)	[2,015]	{1,007}	42,068	(8,414)	[2,019]	{1,010}
Shelby	91,953	92,106	92,365	92,549	92,896	(18,579)	[4,459]	{2,230}	93,262	(18,652)	[4,477]	{2,238}	93,650	(18,730)	[4,495]	{2,248}
Sumner	22,983	23,020	23,064	23,112	23,181	(4,636)	[1,113]	{556}	23,252	(4,650)	[1,116]	{558}	23,320	(4,664)	[1,119]	{560}
Williamson	27,036	27,085	27,127	27,184	27,255	(5,451)	[1,308]	{654}	27,326	(5,465)	[1,312]	{656}	27,397	(5,479)	[1,315]	{658}

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.