

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

Date: 1/8/21

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 1/8/21 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.

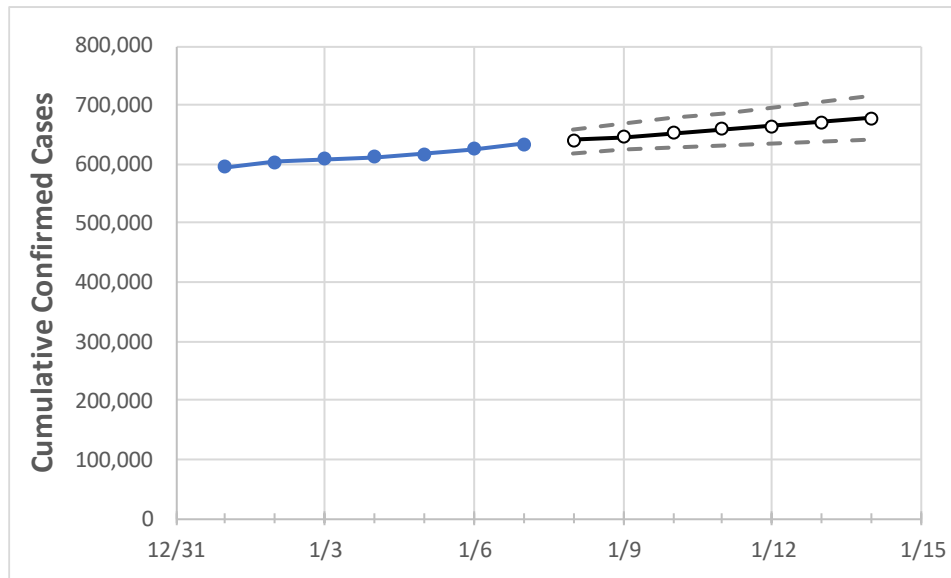
IEM's Modeling Lead

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Tennessee	612,250	617,649	625,380	634,237	640,474	646,726	652,910	658,865	665,215	671,226	677,397

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:						
	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14
Blount	10,433	10,494	10,632	10,803	10,925	11,053	11,179	11,304	11,431	11,556	11,679
Davidson	63,317	63,708	64,869	65,739	66,261	66,770	67,272	67,782	68,301	68,812	69,341
Hamilton	29,951	30,317	30,853	31,283	31,651	32,038	32,426	32,824	33,234	33,648	34,033
Knox	34,131	34,448	34,928	35,441	35,821	36,198	36,590	36,969	37,340	37,722	38,100
Rutherford	29,609	29,823	30,200	30,617	30,897	31,183	31,463	31,746	32,028	32,304	32,577
Shelby	69,131	69,666	70,242	71,084	71,655	72,201	72,777	73,351	73,913	74,483	75,043
Sumner	16,390	16,501	16,714	16,992	17,135	17,281	17,423	17,565	17,707	17,853	17,993
Williamson	18,829	19,037	19,346	19,703	19,954	20,212	20,469	20,722	20,982	21,239	21,502

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:											
	1/4	1/5	1/6	1/7	1/9				1/11				1/13			
Blount	10,433	10,494	10,632	10,803	11,053	(2,211)	[531]	{265}	11,304	(2,261)	[543]	{271}	11,556	(2,311)	[555]	{277}
Davidson	63,317	63,708	64,869	65,739	66,770	(13,354)	[3,205]	{1,602}	67,782	(13,556)	[3,254]	{1,627}	68,812	(13,762)	[3,303]	{1,651}
Hamilton	29,951	30,317	30,853	31,283	32,038	(6,408)	[1,538]	{769}	32,824	(6,565)	[1,576]	{788}	33,648	(6,730)	[1,615]	{808}
Knox	34,131	34,448	34,928	35,441	36,198	(7,240)	[1,738]	{869}	36,969	(7,394)	[1,775]	{887}	37,722	(7,544)	[1,811]	{905}
Rutherford	29,609	29,823	30,200	30,617	31,183	(6,237)	[1,497]	{748}	31,746	(6,349)	[1,524]	{762}	32,304	(6,461)	[1,551]	{775}
Shelby	69,131	69,666	70,242	71,084	72,201	(14,440)	[3,466]	{1,733}	73,351	(14,670)	[3,521]	{1,760}	74,483	(14,897)	[3,575]	{1,788}
Sumner	16,390	16,501	16,714	16,992	17,281	(3,456)	[829]	{415}	17,565	(3,513)	[843]	{422}	17,853	(3,571)	[857]	{428}
Williamson	18,829	19,037	19,346	19,703	20,212	(4,042)	[970]	{485}	20,722	(4,144)	[995]	{497}	21,239	(4,248)	[1,019]	{510}

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.