

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

Date: 1/11/21

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 1/11/21 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.

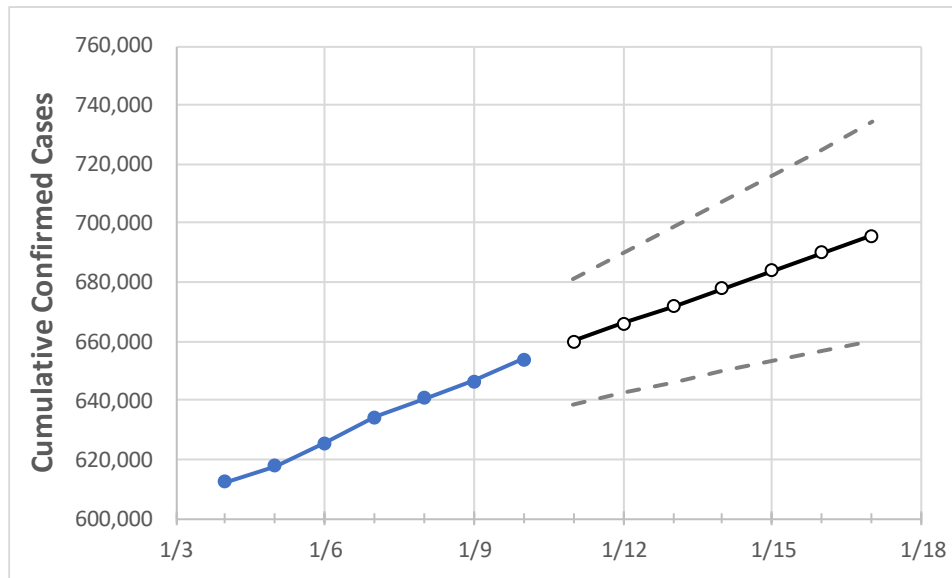
IEM's Modeling Lead

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Tennessee	634,237	640,606	646,450	653,869	659,975	666,065	671,884	677,977	683,926	689,866	695,826

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Blount	10,803	10,905	11,013	11,127	11,243	11,358	11,471	11,577	11,691	11,801	11,914
Davidson	65,739	66,301	66,901	67,645	68,221	68,788	69,357	69,937	70,506	71,080	71,665
Hamilton	31,283	31,775	32,082	32,446	32,851	33,255	33,675	34,074	34,481	34,905	35,311
Knox	35,441	35,907	36,306	36,717	37,103	37,501	37,891	38,291	38,677	39,075	39,472
Rutherford	30,617	30,893	31,214	31,563	31,837	32,111	32,381	32,654	32,931	33,201	33,466
Shelby	71,084	71,590	72,183	72,840	73,395	73,968	74,537	75,101	75,676	76,242	76,825
Sumner	16,992	17,105	17,243	17,405	17,552	17,699	17,845	17,989	18,134	18,273	18,412
Williamson	19,703	19,897	20,063	20,319	20,553	20,796	21,038	21,282	21,524	21,765	22,016

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:											
	1/7	1/8	1/9	1/10	1/12				1/14				1/16			
Blount	10,803	10,905	11,013	11,127	11,358	(2,272)	[545]	{273}	11,577	(2,315)	[556]	{278}	11,801	(2,360)	[566]	{283}
Davidson	65,739	66,301	66,901	67,645	68,788	(13,758)	[3,302]	{1,651}	69,937	(13,987)	[3,357]	{1,678}	71,080	(14,216)	[3,412]	{1,706}
Hamilton	31,283	31,775	32,082	32,446	33,255	(6,651)	[1,596]	{798}	34,074	(6,815)	[1,636]	{818}	34,905	(6,981)	[1,675]	{838}
Knox	35,441	35,907	36,306	36,717	37,501	(7,500)	[1,800]	{900}	38,291	(7,658)	[1,838]	{919}	39,075	(7,815)	[1,876]	{938}
Rutherford	30,617	30,893	31,214	31,563	32,111	(6,422)	[1,541]	{771}	32,654	(6,531)	[1,567]	{784}	33,201	(6,640)	[1,594]	{797}
Shelby	71,084	71,590	72,183	72,840	73,968	(14,794)	[3,550]	{1,775}	75,101	(15,020)	[3,605]	{1,802}	76,242	(15,248)	[3,660]	{1,830}
Sumner	16,992	17,105	17,243	17,405	17,699	(3,540)	[850]	{425}	17,989	(3,598)	[863]	{432}	18,273	(3,655)	[877]	{439}
Williamson	19,703	19,897	20,063	20,319	20,796	(4,159)	[998]	{499}	21,282	(4,256)	[1,022]	{511}	21,765	(4,353)	[1,045]	{522}

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.