

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

Date: 2/11/21

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 2/11/21 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.

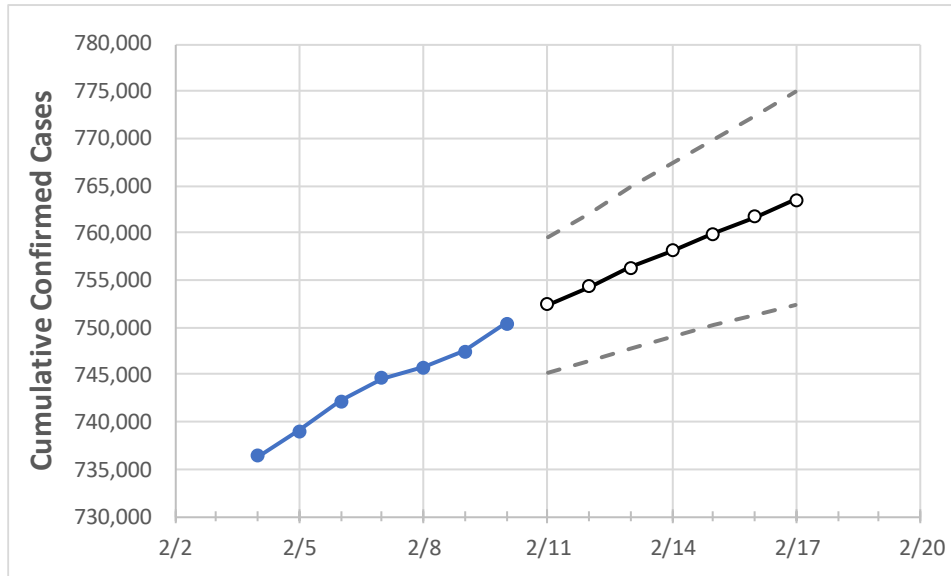
IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Tennessee	744,600	745,826	747,462	750,409	752,411	754,368	756,294	758,100	759,938	761,726	763,521

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Blount	12,972	13,016	13,074	13,212	13,266	13,321	13,375	13,429	13,487	13,544	13,601
Davidson	76,465	76,578	76,662	77,018	77,195	77,365	77,529	77,686	77,843	77,990	78,140
Hamilton	38,169	38,259	38,354	38,421	38,538	38,652	38,763	38,866	38,973	39,079	39,177
Knox	42,711	42,824	42,916	43,033	43,175	43,307	43,438	43,566	43,691	43,817	43,936
Rutherford	35,950	36,036	36,115	36,273	36,381	36,482	36,584	36,682	36,778	36,874	36,967
Shelby	82,845	82,975	83,147	83,324	83,524	83,723	83,921	84,115	84,300	84,483	84,654
Sumner	19,803	19,852	19,892	19,975	20,035	20,092	20,150	20,207	20,263	20,318	20,373
Williamson	23,767	23,824	23,860	23,934	24,021	24,107	24,187	24,268	24,348	24,427	24,504

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:											
	2/7	2/8	2/9	2/10	2/12			2/14			2/16					
Blount	12,972	13,016	13,074	13,212	13,321	(2,664)	{639}	{320}	13,429	(2,686)	{645}	{322}	13,544	(2,709)	{650}	{325}
Davidson	76,465	76,578	76,662	77,018	77,365	(15,473)	{3,714}	{1,857}	77,686	(15,537)	{3,729}	{1,864}	77,990	(15,598)	{3,744}	{1,872}
Hamilton	38,169	38,259	38,354	38,421	38,652	(7,730)	{1,855}	{928}	38,866	(7,773)	{1,866}	{933}	39,079	(7,816)	{1,876}	{938}
Knox	42,711	42,824	42,916	43,033	43,307	(8,661)	{2,079}	{1,039}	43,566	(8,713)	{2,091}	{1,046}	43,817	(8,763)	{2,103}	{1,052}
Rutherford	35,950	36,036	36,115	36,273	36,482	(7,296)	{1,751}	{876}	36,682	(7,336)	{1,761}	{880}	36,874	(7,375)	{1,770}	{885}
Shelby	82,845	82,975	83,147	83,324	83,723	(16,745)	{4,019}	{2,009}	84,115	(16,823)	{4,037}	{2,019}	84,483	(16,897)	{4,055}	{2,028}
Sumner	19,803	19,852	19,892	19,975	20,092	(4,018)	{964}	{482}	20,207	(4,041)	{970}	{485}	20,318	(4,064)	{975}	{488}
Williamson	23,767	23,824	23,860	23,934	24,107	(4,821)	{1,157}	{579}	24,268	(4,854)	{1,165}	{582}	24,427	(4,885)	{1,172}	{586}

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.