

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

Date: 2/19/21

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 2/19/21 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.

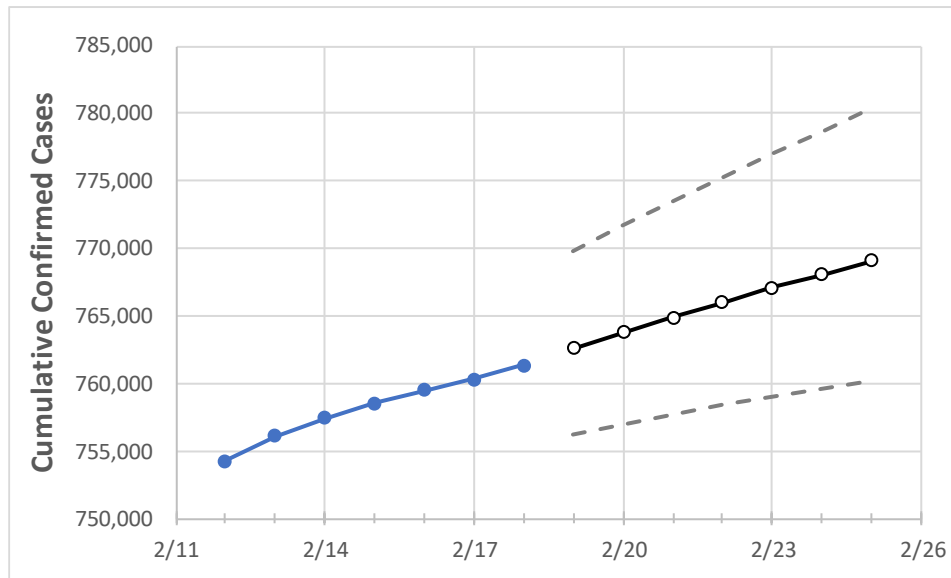
IEM's Modeling Lead

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:						
	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25
Tennessee	758,561	759,523	760,303	761,360	762,577	763,776	764,918	765,995	767,072	768,097	769,081

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:						
	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25
Blount	13,695	13,738	13,778	13,800	13,874	13,953	14,029	14,108	14,187	14,268	14,351
Davidson	79,542	79,851	79,924	80,026	80,338	80,664	80,994	81,324	81,654	81,993	82,337
Hamilton	39,044	39,152	39,277	39,420	39,517	39,617	39,711	39,804	39,893	39,979	40,063
Knox	44,168	44,340	44,477	44,614	44,793	44,973	45,146	45,324	45,494	45,668	45,841
Rutherford	37,217	37,335	37,397	37,417	37,548	37,681	37,810	37,943	38,075	38,207	38,342
Shelby	85,474	85,775	85,813	85,858	86,121	86,378	86,631	86,885	87,136	87,391	87,648
Sumner	20,884	20,912	20,939	20,964	21,055	21,143	21,237	21,328	21,427	21,526	21,624
Williamson	24,549	24,612	24,633	24,656	24,727	24,796	24,865	24,926	24,988	25,051	25,115

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:											
	2/15	2/16	2/17	2/18	2/20				2/22				2/24			
Blount	13,695	13,738	13,778	13,800	13,953	(2,791)	[670]	{335}	14,108	(2,822)	[677]	{339}	14,268	(2,854)	[685]	{342}
Davidson	79,542	79,851	79,924	80,026	80,664	(16,133)	[3,872]	{1,936}	81,324	(16,265)	[3,904]	{1,952}	81,993	(16,399)	[3,936]	{1,968}
Hamilton	39,044	39,152	39,277	39,420	39,617	(7,923)	[1,902]	{951}	39,804	(7,961)	[1,911]	{955}	39,979	(7,996)	[1,919]	{959}
Knox	44,168	44,340	44,477	44,614	44,973	(8,995)	[2,159]	{1,079}	45,324	(9,065)	[2,176]	{1,088}	45,668	(9,134)	[2,192]	{1,096}
Rutherford	37,217	37,335	37,397	37,417	37,681	(7,536)	[1,809]	{904}	37,943	(7,589)	[1,821]	{911}	38,207	(7,641)	[1,834]	{917}
Shelby	85,474	85,775	85,813	85,858	86,378	(17,276)	[4,146]	{2,073}	86,885	(17,377)	[4,170]	{2,085}	87,391	(17,478)	[4,195]	{2,097}
Sumner	20,884	20,912	20,939	20,964	21,143	(4,229)	[1,015]	{507}	21,328	(4,266)	[1,024]	{512}	21,526	(4,305)	[1,033]	{517}
Williamson	24,549	24,612	24,633	24,656	24,796	(4,959)	[1,190]	{595}	24,926	(4,985)	[1,196]	{598}	25,051	(5,010)	[1,202]	{601}

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.