

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

Date: 2/23/22

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 2/23/22 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.

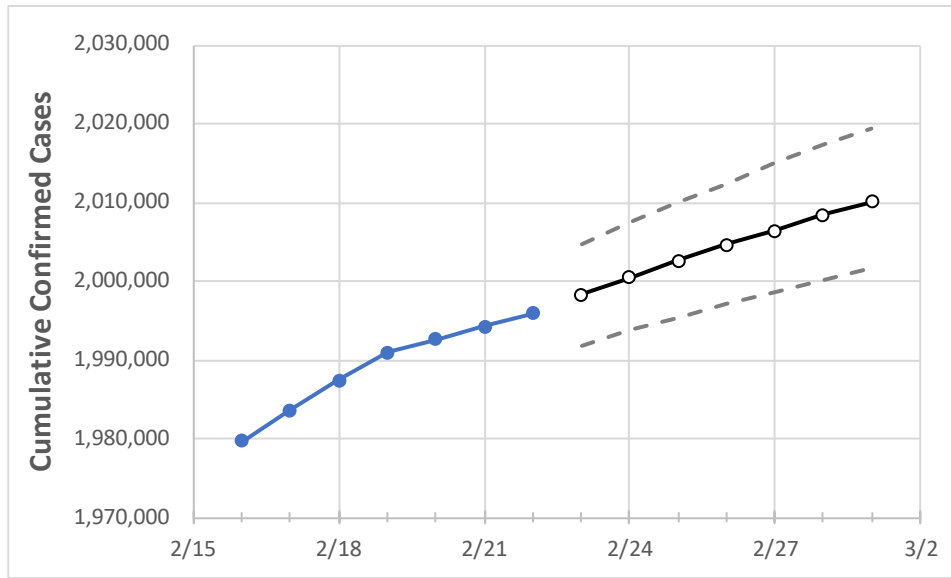
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1

Tennessee 1,991,015 1,992,644 1,994,272 1,995,901 1,998,292 2,000,462 2,002,583 2,004,647 2,006,471 2,008,395 2,010,081

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Blount	38,344	38,344	38,344	38,344	38,410	38,476	38,534	38,586	38,646	38,692	38,742
Davidson	186,939	186,939	186,939	186,939	187,163	187,372	187,583	187,780	187,962	188,146	188,316
Hamilton	96,154	96,154	96,154	96,154	96,288	96,414	96,539	96,657	96,772	96,870	96,979
Knox	124,205	124,205	124,205	124,205	124,446	124,671	124,884	125,066	125,272	125,462	125,631
Rutherford	93,990	93,990	93,990	93,990	94,090	94,194	94,285	94,373	94,457	94,531	94,612
Shelby	231,538	231,538	231,538	231,538	231,753	231,951	232,135	232,313	232,487	232,658	232,810
Sumner	52,168	52,168	52,168	52,168	52,230	52,297	52,358	52,415	52,471	52,520	52,566
Williamson	60,877	60,877	60,877	60,877	60,962	61,044	61,121	61,197	61,269	61,346	61,408

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:											
	2/19	2/20	2/21	2/22	2/24				2/26				2/28			
Blount	38,344	38,344	38,344	38,344	38,476	(7,695)	[1,847]	{923}	38,586	(7,717)	[1,852]	{926}	38,692	(7,738)	[1,857]	{929}
Davidson	186,939	186,939	186,939	186,939	187,372	(37,474)	[8,994]	{4,497}	187,780	(37,556)	[9,013]	{4,507}	188,146	(37,629)	[9,031]	{4,516}
Hamilton	96,154	96,154	96,154	96,154	96,414	(19,283)	[4,628]	{2,314}	96,657	(19,331)	[4,640]	{2,320}	96,870	(19,374)	[4,650]	{2,325}
Knox	124,205	124,205	124,205	124,205	124,671	(24,934)	[5,984]	{2,992}	125,066	(25,013)	[6,003]	{3,002}	125,462	(25,092)	[6,022]	{3,011}
Rutherford	93,990	93,990	93,990	93,990	94,194	(18,839)	[4,521]	{2,261}	94,373	(18,875)	[4,530]	{2,265}	94,531	(18,906)	[4,537]	{2,269}
Shelby	231,538	231,538	231,538	231,538	231,951	(46,390)	[11,134]	{5,567}	232,313	(46,463)	[11,151]	{5,576}	232,658	(46,532)	[11,168]	{5,584}
Sumner	52,168	52,168	52,168	52,168	52,297	(10,459)	[2,510]	{1,255}	52,415	(10,483)	[2,516]	{1,258}	52,520	(10,504)	[2,521]	{1,260}
Williamson	60,877	60,877	60,877	60,877	61,044	(12,209)	[2,930]	{1,465}	61,197	(12,239)	[2,937]	{1,469}	61,346	(12,269)	[2,945]	{1,472}

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.