

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

Date: 9/3/21

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 9/3/21 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.

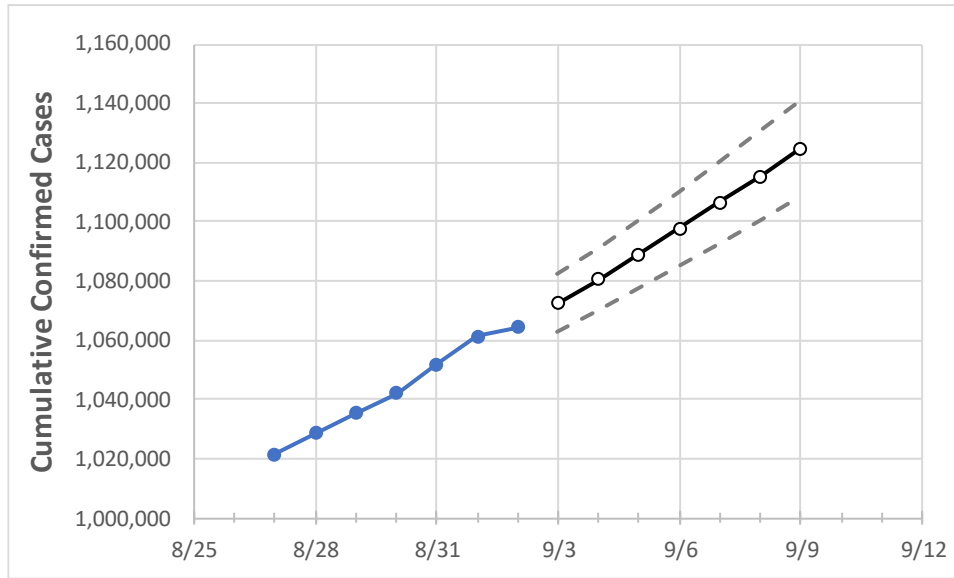
IEM's Modeling Lead

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:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9

Tennessee 1,042,123 1,051,809 1,061,228 1,064,427 1,072,529 1,080,636 1,089,104 1,097,705 1,106,477 1,115,410 1,124,815

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:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Blount	18,814	18,924	19,064	19,177	19,301	19,424	19,552	19,681	19,812	19,948	20,083
Davidson	103,471	104,148	104,737	104,846	105,304	105,757	106,232	106,721	107,194	107,699	108,197
Hamilton	53,613	53,970	54,369	54,565	54,864	55,167	55,478	55,791	56,115	56,442	56,771
Knox	61,321	61,842	62,422	62,690	63,200	63,730	64,264	64,820	65,399	65,996	66,607
Rutherford	51,144	51,683	52,127	52,186	52,552	52,928	53,307	53,696	54,110	54,519	54,948
Shelby	123,809	124,782	125,579	125,862	126,617	127,377	128,116	128,894	129,651	130,449	131,246
Sumner	29,350	29,584	29,801	29,854	30,054	30,252	30,451	30,655	30,860	31,073	31,289
Williamson	33,706	33,943	34,190	34,283	34,473	34,662	34,851	35,045	35,243	35,445	35,649

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:											
	8/30	8/31	9/1	9/2	9/4			9/6			9/8					
Blount	18,814	18,924	19,064	19,177	19,424	(3,885)	[932]	{466}	19,681	(3,936)	[945]	{472}	19,948	(3,990)	[957]	{479}
Davidson	103,471	104,148	104,737	104,846	105,757	(21,151)	[5,076]	{2,538}	106,721	(21,344)	[5,123]	{2,561}	107,699	(21,540)	[5,170]	{2,585}
Hamilton	53,613	53,970	54,369	54,565	55,167	(11,033)	[2,648]	{1,324}	55,791	(11,158)	[2,678]	{1,339}	56,442	(11,288)	[2,709]	{1,355}
Knox	61,321	61,842	62,422	62,690	63,730	(12,746)	[3,059]	{1,530}	64,820	(12,964)	[3,111]	{1,556}	65,996	(13,199)	[3,168]	{1,584}
Rutherford	51,144	51,683	52,127	52,186	52,928	(10,586)	[2,541]	{1,270}	53,696	(10,739)	[2,577]	{1,289}	54,519	(10,904)	[2,617]	{1,308}
Shelby	123,809	124,782	125,579	125,862	127,377	(25,475)	[6,114]	{3,057}	128,894	(25,779)	[6,187]	{3,093}	130,449	(26,090)	[6,262]	{3,131}
Sumner	29,350	29,584	29,801	29,854	30,252	(6,050)	[1,452]	{726}	30,655	(6,131)	[1,471]	{736}	31,073	(6,215)	[1,492]	{746}
Williamson	33,706	33,943	34,190	34,283	34,662	(6,932)	[1,664]	{832}	35,045	(7,009)	[1,682]	{841}	35,445	(7,089)	[1,701]	{851}

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.