

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

Date: 10/9/20

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 10/9/20 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.

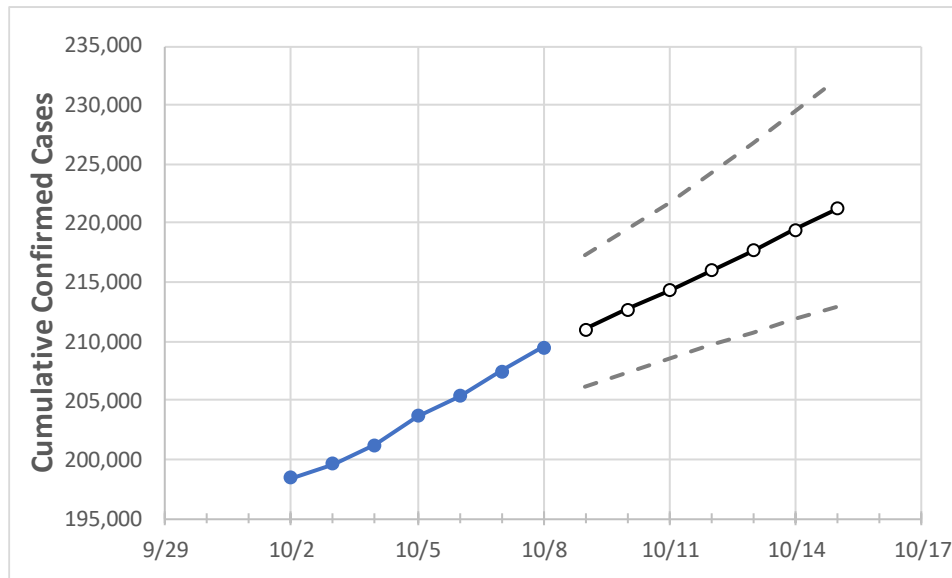
IEM's Modeling Lead

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:						
	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15
Tennessee	203,699	205,375	207,455	209,447	211,046	212,671	214,321	215,997	217,700	219,429	221,185

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 20%, and are often within 10%, of actual confirmed cases.

Tennessee Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15
Blount	2,696	2,707	2,741	2,772	2,795	2,818	2,843	2,868	2,893	2,919	2,946
Davidson	27,360	27,518	27,636	27,765	27,865	27,967	28,071	28,175	28,281	28,389	28,498
Hamilton	9,964	10,094	10,166	10,250	10,324	10,400	10,477	10,556	10,636	10,718	10,802
Knox	10,088	10,202	10,288	10,393	10,472	10,550	10,628	10,707	10,785	10,863	10,941
Rutherford	9,807	9,884	9,978	10,048	10,116	10,185	10,255	10,327	10,399	10,473	10,549
Shelby	31,840	32,016	32,138	32,280	32,395	32,509	32,624	32,738	32,852	32,966	33,079
Sumner	5,088	5,109	5,138	5,169	5,197	5,226	5,256	5,286	5,316	5,347	5,378
Williamson	5,674	5,735	5,798	5,833	5,886	5,940	5,996	6,054	6,113	6,175	6,238

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:											
	10/5	10/6	10/7	10/8	10/10				10/12				10/14			
Blount	2,696	2,707	2,741	2,772	2,818	(564)	[135]	{68}	2,868	(574)	[138]	{69}	2,919	(584)	[140]	{70}
Davidson	27,360	27,518	27,636	27,765	27,967	(5,593)	[1,342]	{671}	28,175	(5,635)	[1,352]	{676}	28,389	(5,678)	[1,363]	{681}
Hamilton	9,964	10,094	10,166	10,250	10,400	(2,080)	[499]	{250}	10,556	(2,111)	[507]	{253}	10,718	(2,144)	[514]	{257}
Knox	10,088	10,202	10,288	10,393	10,550	(2,110)	[506]	{253}	10,707	(2,141)	[514]	{257}	10,863	(2,173)	[521]	{261}
Rutherford	9,807	9,884	9,978	10,048	10,185	(2,037)	[489]	{244}	10,327	(2,065)	[496]	{248}	10,473	(2,095)	[503]	{251}
Shelby	31,840	32,016	32,138	32,280	32,509	(6,502)	[1,560]	{780}	32,738	(6,548)	[1,571]	{786}	32,966	(6,593)	[1,582]	{791}
Sumner	5,088	5,109	5,138	5,169	5,226	(1,045)	[251]	{125}	5,286	(1,057)	[254]	{127}	5,347	(1,069)	[257]	{128}
Williamson	5,674	5,735	5,798	5,833	5,940	(1,188)	[285]	{143}	6,054	(1,211)	[291]	{145}	6,175	(1,235)	[296]	{148}

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.