

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 12/22/20**

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 12/22/20 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.**

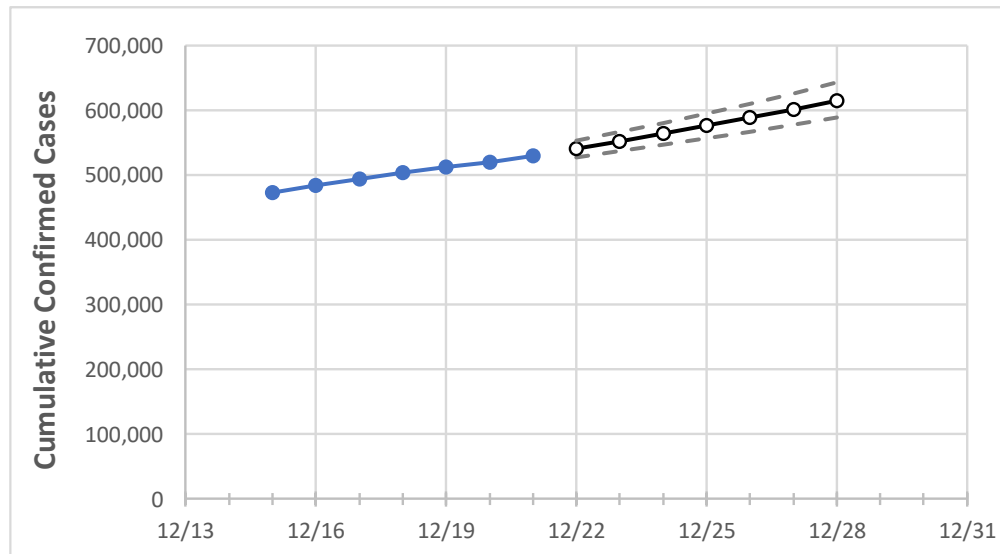
**IEM's Modeling Lead**

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Tennessee	503,651	511,669	519,687	529,578	540,561	551,906	563,625	575,728	588,226	601,131	614,453

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:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Blount	8,222	8,380	8,538	8,721	8,914	9,114	9,321	9,534	9,754	9,982	10,217
Davidson	53,933	54,613	55,293	56,159	57,047	57,969	58,924	59,913	60,938	61,999	63,097
Hamilton	23,691	24,063	24,435	25,021	25,597	26,199	26,827	27,483	28,167	28,880	29,623
Knox	27,402	27,897	28,391	28,899	29,549	30,221	30,915	31,633	32,374	33,139	33,930
Rutherford	24,821	25,175	25,529	25,953	26,472	27,006	27,556	28,123	28,707	29,308	29,926
Shelby	59,370	60,000	60,630	61,444	62,320	63,224	64,157	65,118	66,109	67,130	68,183
Sumner	13,676	13,879	14,081	14,339	14,606	14,880	15,160	15,446	15,739	16,039	16,345
Williamson	15,062	15,317	15,572	15,848	16,150	16,465	16,791	17,131	17,483	17,849	18,228

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:											
	12/18	12/19	12/20	12/21	12/23				12/25				12/27			
Blount	8,222	8,380	8,538	8,721	9,114	(1,823)	[437]	{219}	9,534	(1,907)	[458]	{229}	9,982	(1,996)	[479]	{240}
Davidson	53,933	54,613	55,293	56,159	57,969	(11,594)	[2,783]	{1,391}	59,913	(11,983)	[2,876]	{1,438}	61,999	(12,400)	[2,976]	{1,488}
Hamilton	23,691	24,063	24,435	25,021	26,199	(5,240)	[1,258]	{629}	27,483	(5,497)	[1,319]	{660}	28,880	(5,776)	[1,386]	{693}
Knox	27,402	27,897	28,391	28,899	30,221	(6,044)	[1,451]	{725}	31,633	(6,327)	[1,518]	{759}	33,139	(6,628)	[1,591]	{795}
Rutherford	24,821	25,175	25,529	25,953	27,006	(5,401)	[1,296]	{648}	28,123	(5,625)	[1,350]	{675}	29,308	(5,862)	[1,407]	{703}
Shelby	59,370	60,000	60,630	61,444	63,224	(12,645)	[3,035]	{1,517}	65,118	(13,024)	[3,126]	{1,563}	67,130	(13,426)	[3,222]	{1,611}
Sumner	13,676	13,879	14,081	14,339	14,880	(2,976)	[714]	{357}	15,446	(3,089)	[741]	{371}	16,039	(3,208)	[770]	{385}
Williamson	15,062	15,317	15,572	15,848	16,465	(3,293)	[790]	{395}	17,131	(3,426)	[822]	{411}	17,849	(3,570)	[857]	{428}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.