

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

Date: 10/23/20

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 10/23/20 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.**

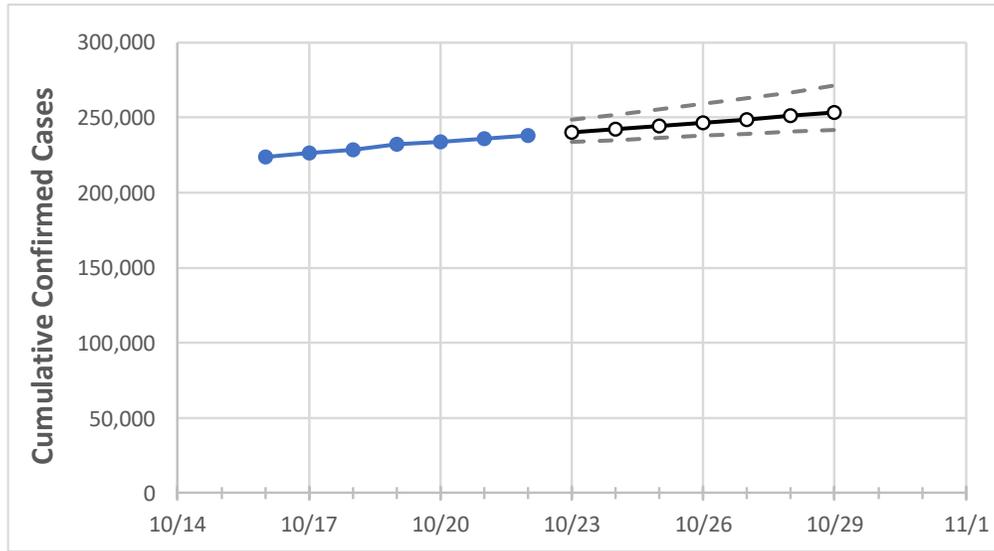
### IEM's Modeling Lead

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:						
	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29
Tennessee	232,061	233,569	235,861	237,907	240,018	242,166	244,350	246,571	248,830	251,127	253,463

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:						
	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29
Blount	3,102	3,139	3,170	3,191	3,226	3,261	3,297	3,335	3,373	3,413	3,453
Davidson	29,801	29,914	30,155	30,302	30,496	30,697	30,905	31,119	31,340	31,569	31,805
Hamilton	11,097	11,197	11,289	11,368	11,450	11,532	11,615	11,700	11,784	11,870	11,957
Knox	11,833	11,936	12,081	12,174	12,302	12,431	12,562	12,694	12,828	12,963	13,100
Rutherford	11,031	11,090	11,165	11,274	11,359	11,444	11,532	11,620	11,709	11,800	11,892
Shelby	34,370	34,523	34,739	34,892	35,076	35,263	35,455	35,650	35,849	36,052	36,259
Sumner	5,636	5,664	5,715	5,788	5,834	5,882	5,932	5,984	6,037	6,092	6,149
Williamson	6,618	6,656	6,707	6,802	6,872	6,943	7,016	7,091	7,168	7,247	7,327

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:											
	10/19	10/20	10/21	10/22	10/24				10/26				10/28			
Blount	3,102	3,139	3,170	3,191	3,261	(652)	[157]	{78}	3,335	(667)	[160]	{80}	3,413	(683)	[164]	{82}
Davidson	29,801	29,914	30,155	30,302	30,697	(6,139)	[1,473]	{737}	31,119	(6,224)	[1,494]	{747}	31,569	(6,314)	[1,515]	{758}
Hamilton	11,097	11,197	11,289	11,368	11,532	(2,306)	[554]	{277}	11,700	(2,340)	[562]	{281}	11,870	(2,374)	[570]	{285}
Knox	11,833	11,936	12,081	12,174	12,431	(2,486)	[597]	{298}	12,694	(2,539)	[609]	{305}	12,963	(2,593)	[622]	{311}
Rutherford	11,031	11,090	11,165	11,274	11,444	(2,289)	[549]	{275}	11,620	(2,324)	[558]	{279}	11,800	(2,360)	[566]	{283}
Shelby	34,370	34,523	34,739	34,892	35,263	(7,053)	[1,693]	{846}	35,650	(7,130)	[1,711]	{856}	36,052	(7,210)	[1,730]	{865}
Sumner	5,636	5,664	5,715	5,788	5,882	(1,176)	[282]	{141}	5,984	(1,197)	[287]	{144}	6,092	(1,218)	[292]	{146}
Williamson	6,618	6,656	6,707	6,802	6,943	(1,389)	[333]	{167}	7,091	(1,418)	[340]	{170}	7,247	(1,449)	[348]	{174}

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.