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

Date: 1/5/21

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 1/5/21 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.

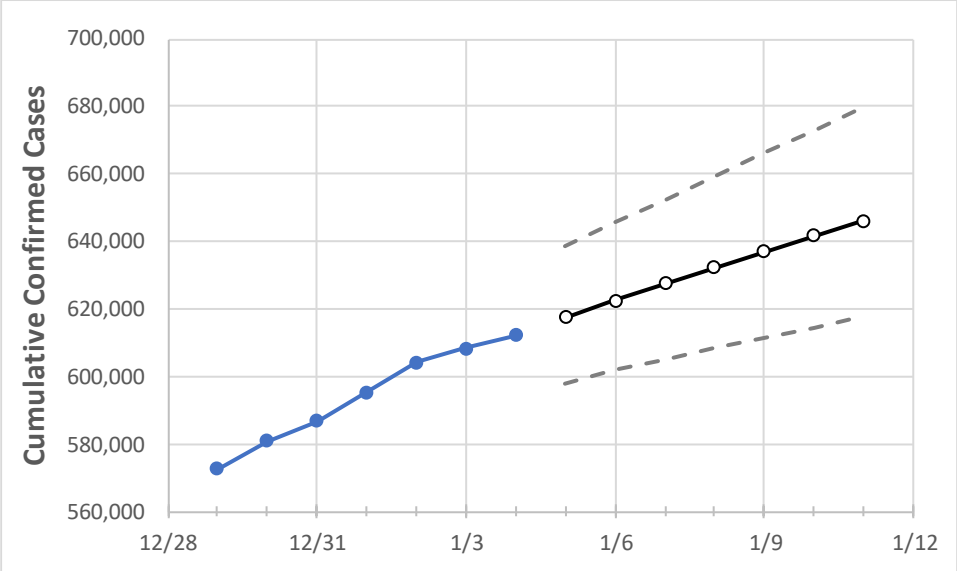
IEM's Modeling Lead

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Tennessee	595,467	604,132	608,297	612,250	617,465	622,457	627,452	632,225	636,994	641,615	646,125

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Blount	10,150	10,324	10,379	10,433	10,551	10,669	10,784	10,897	11,006	11,123	11,238
Davidson	62,169	62,841	63,009	63,317	63,775	64,237	64,680	65,112	65,534	65,974	66,397
Hamilton	28,971	29,398	29,628	29,951	30,295	30,642	30,987	31,330	31,664	32,006	32,334
Knox	33,127	33,602	33,862	34,131	34,465	34,799	35,122	35,439	35,747	36,060	36,366
Rutherford	28,934	29,250	29,378	29,609	29,830	30,047	30,256	30,461	30,662	30,859	31,054
Shelby	67,494	68,426	68,753	69,131	69,635	70,134	70,634	71,116	71,598	72,094	72,551
Sumner	16,015	16,241	16,292	16,390	16,514	16,633	16,748	16,863	16,979	17,093	17,200
Williamson	18,218	18,533	18,641	18,829	19,048	19,266	19,480	19,691	19,910	20,126	20,344

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:		
	1/1	1/2	1/3	1/4	1/6	1/8	1/10
Blount	10,150	10,324	10,379	10,433	10,669 (2,134) [512] {256}	10,897 (2,179) [523] {262}	11,123 (2,225) [534] {267}
Davidson	62,169	62,841	63,009	63,317	64,237 (12,847) [3,083] {1,542}	65,112 (13,022) [3,125] {1,563}	65,974 (13,195) [3,167] {1,583}
Hamilton	28,971	29,398	29,628	29,951	30,642 (6,128) [1,471] {735}	31,330 (6,266) [1,504] {752}	32,006 (6,401) [1,536] {768}
Knox	33,127	33,602	33,862	34,131	34,799 (6,960) [1,670] {835}	35,439 (7,088) [1,701] {851}	36,060 (7,212) [1,731] {865}
Rutherford	28,934	29,250	29,378	29,609	30,047 (6,009) [1,442] {721}	30,461 (6,092) [1,462] {731}	30,859 (6,172) [1,481] {741}
Shelby	67,494	68,426	68,753	69,131	70,134 (14,027) [3,366] {1,683}	71,116 (14,223) [3,414] {1,707}	72,094 (14,419) [3,460] {1,730}
Sumner	16,015	16,241	16,292	16,390	16,633 (3,327) [798] {399}	16,863 (3,373) [809] {405}	17,093 (3,419) [820] {410}
Williamson	18,218	18,533	18,641	18,829	19,266 (3,853) [925] {462}	19,691 (3,938) [945] {473}	20,126 (4,025) [966] {483}

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.