IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/28/21

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 <u>not</u> 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 6/28/21 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
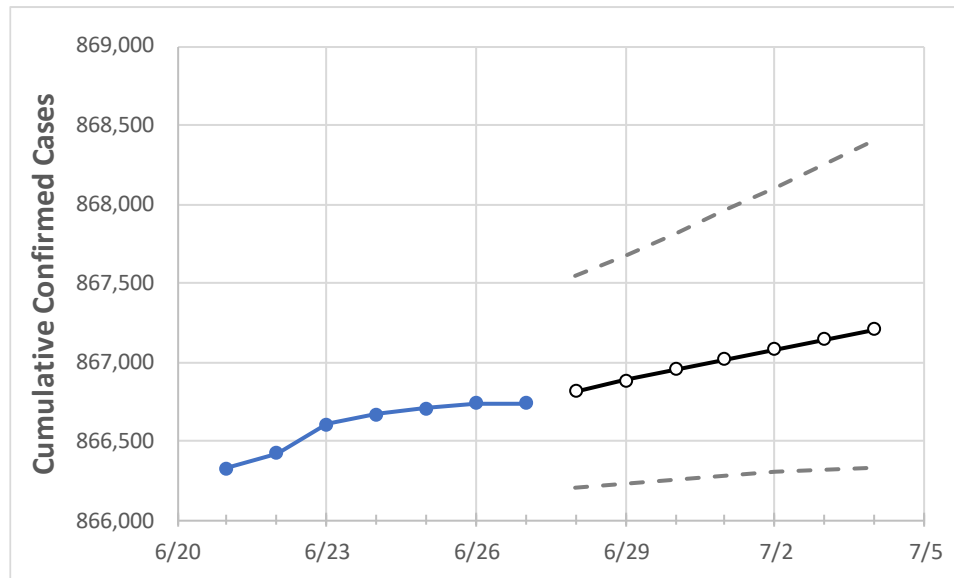
	Actual Confirmed Cases On:				Projected Cases For:						
	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4
Tennessee	866,670	866,704	866,738	866,738	866,812	866,883	866,951	867,017	867,081	867,143	867,204

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:						
	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4
Blount	15,902	15,905	15,907	15,907	15,909	15,911	15,912	15,914	15,916	15,917	15,918
Davidson	90,477	90,468	90,459	90,459	90,464	90,469	90,474	90,480	90,484	90,488	90,492
Hamilton	45,385	45,392	45,398	45,398	45,406	45,413	45,420	45,426	45,432	45,437	45,443
Knox	52,113	52,117	52,120	52,120	52,131	52,142	52,152	52,162	52,171	52,180	52,188
Rutherford	43,717	43,717	43,716	43,716	43,719	43,721	43,724	43,727	43,729	43,731	43,733
Shelby	98,547	98,555	98,562	98,562	98,585	98,607	98,628	98,649	98,669	98,689	98,708
Sumner	24,510	24,511	24,511	24,511	24,513	24,515	24,517	24,519	24,521	24,523	24,525
Williamson	28,619	28,621	28,622	28,622	28,623	28,624	28,626	28,627	28,628	28,629	28,630

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:		
	6/24	6/25	6/26	6/27	6/29	7/1	7/3
Blount	15,902	15,905	15,907	15,907	15,911 (3,182) [764] {382}	15,914 (3,183) [764] {382}	15,917 (3,183) [764] {382}
Davidson	90,477	90,468	90,459	90,459	90,469 (18,094) [4,343] {2,171}	90,480 (18,096) [4,343] {2,172}	90,488 (18,098) [4,343] {2,172}
Hamilton	45,385	45,392	45,398	45,398	45,413 (9,083) [2,180] {1,090}	45,426 (9,085) [2,180] {1,090}	45,437 (9,087) [2,181] {1,090}
Knox	52,113	52,117	52,120	52,120	52,142 (10,428) [2,503] {1,251}	52,162 (10,432) [2,504] {1,252}	52,180 (10,436) [2,505] {1,252}
Rutherford	43,717	43,717	43,716	43,716	43,721 (8,744) [2,099] {1,049}	43,727 (8,745) [2,099] {1,049}	43,731 (8,746) [2,099] {1,050}
Shelby	98,547	98,555	98,562	98,562	98,607 (19,721) [4,733] {2,367}	98,649 (19,730) [4,735] {2,368}	98,689 (19,738) [4,737] {2,369}
Sumner	24,510	24,511	24,511	24,511	24,515 (4,903) [1,177] {588}	24,519 (4,904) [1,177] {588}	24,523 (4,905) [1,177] {589}
Williamson	28,619	28,621	28,622	28,622	28,624 (5,725) [1,374] {687}	28,627 (5,725) [1,374] {687}	28,629 (5,726) [1,374] {687}

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.