IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/22/21

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 6/22/21 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
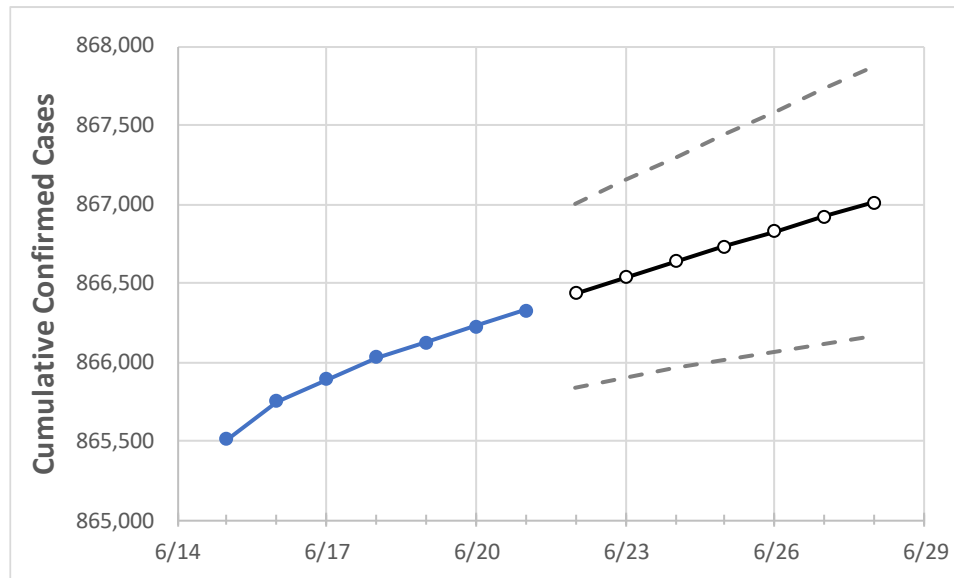
	Actual Confirmed Cases On:				Projected Cases For:						
	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28
Tennessee	866,027	866,126	866,225	866,324	866,433	866,538	866,638	866,735	866,828	866,921	867,012

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:						
	6/18	6/19	6/20	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28
Blount	15,888	15,890	15,891	15,893	15,900	15,907	15,915	15,922	15,930	15,938	15,946
Davidson	90,485	90,483	90,482	90,480	90,489	90,497	90,506	90,514	90,522	90,530	90,538
Hamilton	45,336	45,340	45,344	45,348	45,362	45,376	45,390	45,404	45,418	45,431	45,444
Knox	51,977	52,014	52,051	52,088	52,110	52,132	52,153	52,173	52,194	52,214	52,235
Rutherford	43,706	43,706	43,706	43,706	43,719	43,732	43,745	43,758	43,772	43,785	43,799
Shelby	98,401	98,421	98,441	98,461	98,485	98,508	98,529	98,551	98,573	98,594	98,614
Sumner	24,496	24,499	24,501	24,504	24,509	24,513	24,518	24,522	24,527	24,531	24,535
Williamson	28,608	28,609	28,610	28,611	28,613	28,615	28,617	28,619	28,620	28,622	28,623

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: | | |
	6/18	6/19	6/20	6/21	6/23	6/25	6/27
Blount	15,888	15,890	15,891	15,893	15,907 (3,181) [764] {382}	15,922 (3,184) [764] {382}	15,938 (3,188) [765] {383}
Davidson	90,485	90,483	90,482	90,480	90,497 (18,099) [4,344] {2,172}	90,514 (18,103) [4,345] {2,172}	90,530 (18,106) [4,345] {2,173}
Hamilton	45,336	45,340	45,344	45,348	45,376 (9,075) [2,178] {1,089}	45,404 (9,081) [2,179] {1,090}	45,431 (9,086) [2,181] {1,090}
Knox	51,977	52,014	52,051	52,088	52,132 (10,426) [2,502] {1,251}	52,173 (10,435) [2,504] {1,252}	52,214 (10,443) [2,506] {1,253}
Rutherford	43,706	43,706	43,706	43,706	43,732 (8,746) [2,099] {1,050}	43,758 (8,752) [2,100] {1,050}	43,785 (8,757) [2,102] {1,051}
Shelby	98,401	98,421	98,441	98,461	98,508 (19,702) [4,728] {2,364}	98,551 (19,710) [4,730] {2,365}	98,594 (19,719) [4,732] {2,366}
Sumner	24,496	24,499	24,501	24,504	24,513 (4,903) [1,177] {588}	24,522 (4,904) [1,177] {589}	24,531 (4,906) [1,177] {589}
Williamson	28,608	28,609	28,610	28,611	28,615 (5,723) [1,374] {687}	28,619 (5,724) [1,374] {687}	28,622 (5,724) [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.