IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/21/21

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 5/21
/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
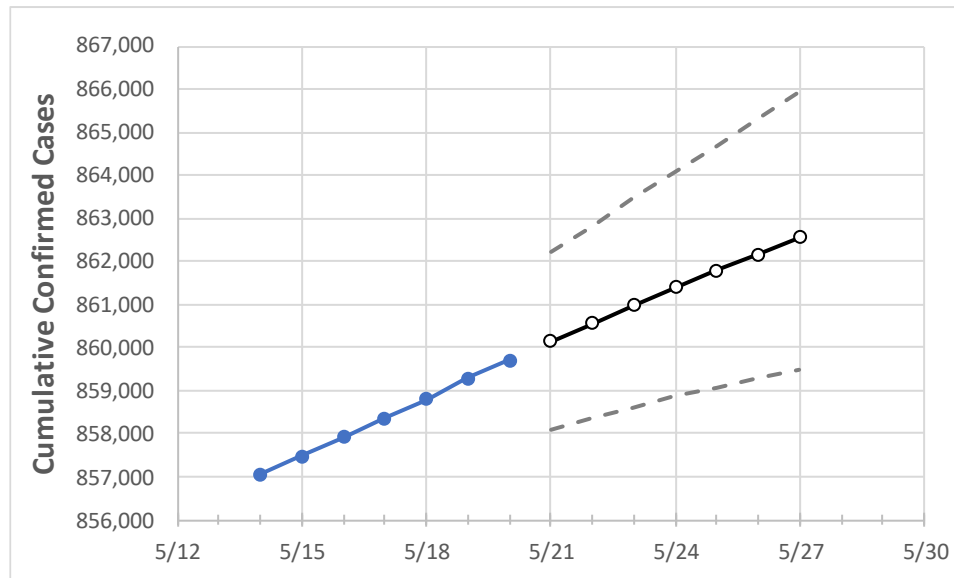
	Actual Confirmed Cases On:				Projected Cases For:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Tennessee	858,355	858,804	859,281	859,701	860,137	860,570	860,991	861,391	861,785	862,171	862,550

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Blount	15,582	15,584	15,599	15,599	15,606	15,612	15,618	15,625	15,631	15,637	15,643
Davidson	89,777	89,827	89,870	89,899	89,932	89,964	89,996	90,028	90,059	90,089	90,117
Hamilton	44,647	44,677	44,710	44,740	44,772	44,803	44,832	44,862	44,892	44,921	44,947
Knox	51,190	51,200	51,225	51,264	51,303	51,342	51,380	51,419	51,455	51,495	51,533
Rutherford	43,278	43,295	43,309	43,341	43,358	43,374	43,390	43,405	43,420	43,434	43,448
Shelby	96,728	96,787	96,867	96,973	97,060	97,146	97,231	97,312	97,394	97,473	97,547
Sumner	24,170	24,188	24,207	24,226	24,240	24,253	24,266	24,279	24,291	24,304	24,316
Williamson	28,148	28,163	28,179	28,194	28,205	28,216	28,226	28,236	28,246	28,255	28,265

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:		
	5/17	5/18	5/19	5/20	5/22	5/24	5/26
Blount	15,582	15,584	15,599	15,599	15,612 (3,122) [749] {375}	15,625 (3,125) [750] {375}	15,637 (3,127) [751] {375}
Davidson	89,777	89,827	89,870	89,899	89,964 (17,993) [4,318] {2,159}	90,028 (18,006) [4,321] {2,161}	90,089 (18,018) [4,324] {2,162}
Hamilton	44,647	44,677	44,710	44,740	44,803 (8,961) [2,151] {1,075}	44,862 (8,972) [2,153] {1,077}	44,921 (8,984) [2,156] {1,078}
Knox	51,190	51,200	51,225	51,264	51,342 (10,268) [2,464] {1,232}	51,419 (10,284) [2,468] {1,234}	51,495 (10,299) [2,472] {1,236}
Rutherford	43,278	43,295	43,309	43,341	43,374 (8,675) [2,082] {1,041}	43,405 (8,681) [2,083] {1,042}	43,434 (8,687) [2,085] {1,042}
Shelby	96,728	96,787	96,867	96,973	97,146 (19,429) [4,663] {2,332}	97,312 (19,462) [4,671] {2,335}	97,473 (19,495) [4,679] {2,339}
Sumner	24,170	24,188	24,207	24,226	24,253 (4,851) [1,164] {582}	24,279 (4,856) [1,165] {583}	24,304 (4,861) [1,167] {583}
Williamson	28,148	28,163	28,179	28,194	28,216 (5,643) [1,354] {677}	28,236 (5,647) [1,355] {678}	28,255 (5,651) [1,356] {678}

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.