IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/20/21

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 5/20/21 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
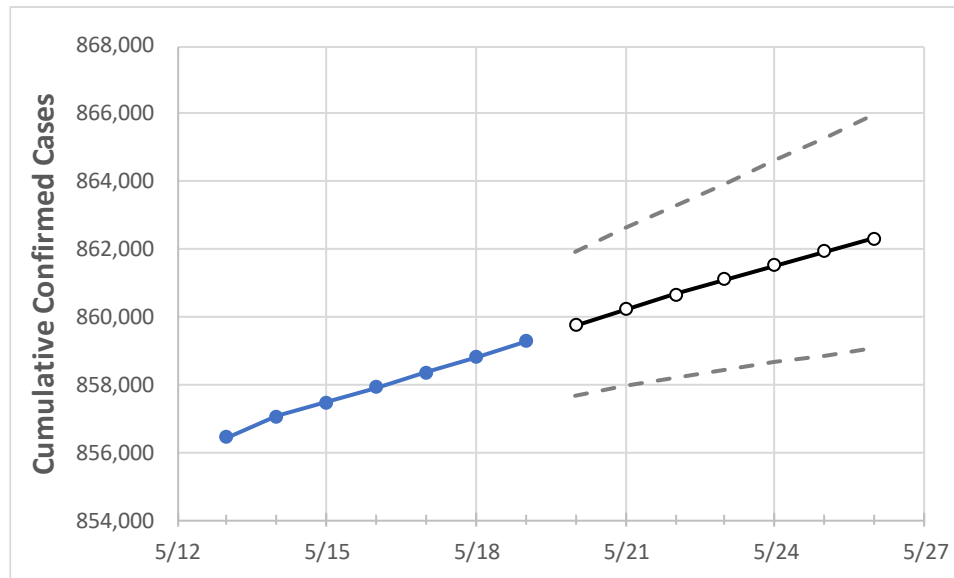
	Actual Confirmed Cases On:				Projected Cases For:						
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
Tennessee	857,922	858,355	858,804	859,281	859,753	860,216	860,664	861,101	861,522	861,926	862,333

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:						
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
Blount	15,574	15,582	15,584	15,599	15,605	15,612	15,617	15,623	15,629	15,634	15,640
Davidson	89,743	89,777	89,827	89,870	89,905	89,940	89,973	90,006	90,039	90,070	90,099
Hamilton	44,621	44,647	44,677	44,710	44,741	44,774	44,805	44,837	44,866	44,895	44,926
Knox	51,165	51,190	51,200	51,225	51,268	51,310	51,352	51,394	51,434	51,474	51,514
Rutherford	43,256	43,278	43,295	43,309	43,326	43,342	43,358	43,373	43,388	43,402	43,416
Shelby	96,636	96,728	96,787	96,867	96,954	97,038	97,120	97,201	97,278	97,356	97,430
Sumner	24,158	24,170	24,188	24,207	24,221	24,233	24,245	24,258	24,269	24,280	24,291
Williamson	28,137	28,148	28,163	28,179	28,190	28,201	28,211	28,222	28,232	28,241	28,250

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:		
	5/16	5/17	5/18	5/19	5/21	5/23	5/25
Blount	15,574	15,582	15,584	15,599	15,612 (3,122) [749] {375}	15,623 (3,125) [750] {375}	15,634 (3,127) [750] {375}
Davidson	89,743	89,777	89,827	89,870	89,940 (17,988) [4,317] {2,159}	90,006 (18,001) [4,320] {2,160}	90,070 (18,014) [4,323] {2,162}
Hamilton	44,621	44,647	44,677	44,710	44,774 (8,955) [2,149] {1,075}	44,837 (8,967) [2,152] {1,076}	44,895 (8,979) [2,155] {1,077}
Knox	51,165	51,190	51,200	51,225	51,310 (10,262) [2,463] {1,231}	51,394 (10,279) [2,467] {1,233}	51,474 (10,295) [2,471] {1,235}
Rutherford	43,256	43,278	43,295	43,309	43,342 (8,668) [2,080] {1,040}	43,373 (8,675) [2,082] {1,041}	43,402 (8,680) [2,083] {1,042}
Shelby	96,636	96,728	96,787	96,867	97,038 (19,408) [4,658] {2,329}	97,201 (19,440) [4,666] {2,333}	97,356 (19,471) [4,673] {2,337}
Sumner	24,158	24,170	24,188	24,207	24,233 (4,847) [1,163] {582}	24,258 (4,852) [1,164] {582}	24,280 (4,856) [1,165] {583}
Williamson	28,137	28,148	28,163	28,179	28,201 (5,640) [1,354] {677}	28,222 (5,644) [1,355] {677}	28,241 (5,648) [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.