IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/11/21

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 6/11/21 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
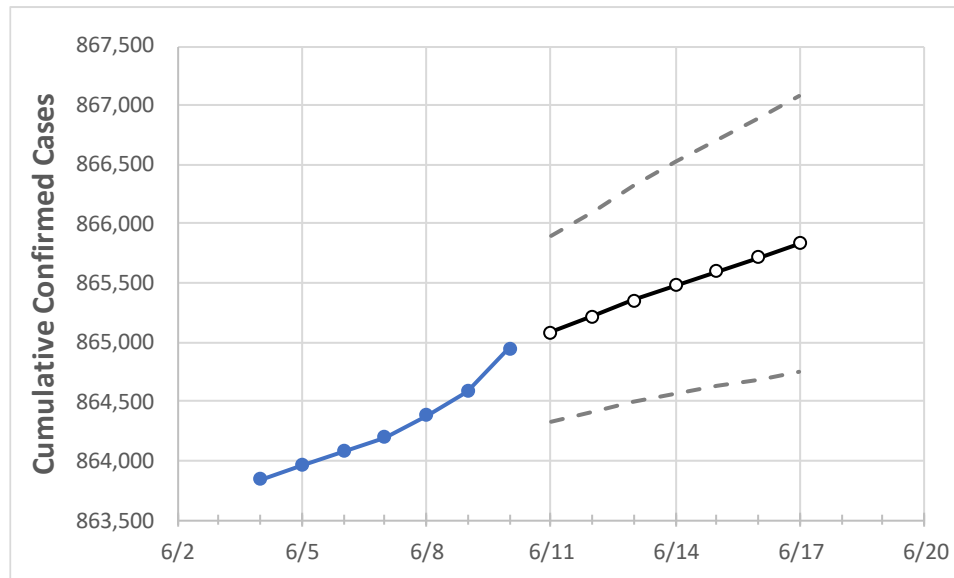
	Actual Confirmed Cases On:				Projected Cases For:						
	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17
Tennessee	864,195	864,384	864,583	864,945	865,087	865,223	865,352	865,480	865,602	865,717	865,835

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:						
	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17
Blount	15,643	15,641	15,639	15,646	15,649	15,653	15,656	15,660	15,663	15,666	15,669
Davidson	90,281	90,296	90,306	90,320	90,332	90,344	90,356	90,366	90,377	90,387	90,397
Hamilton	45,106	45,114	45,125	45,134	45,144	45,153	45,162	45,171	45,179	45,187	45,194
Knox	51,699	51,723	51,741	51,764	51,795	51,828	51,859	51,891	51,922	51,952	51,979
Rutherford	43,525	43,538	43,547	43,552	43,557	43,563	43,568	43,572	43,577	43,581	43,585
Shelby	97,937	97,964	97,991	98,004	98,027	98,048	98,069	98,087	98,105	98,122	98,138
Sumner	24,338	24,341	24,345	24,345	24,347	24,349	24,351	24,352	24,354	24,356	24,357
Williamson	28,334	28,346	28,351	28,351	28,358	28,364	28,371	28,378	28,384	28,391	28,397

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: | | |
	6/7	6/8	6/9	6/10	6/12	6/14	6/16
Blount	15,643	15,641	15,639	15,646	15,653 (3,131) [751] {376}	15,660 (3,132) [752] {376}	15,666 (3,133) [752] {376}
Davidson	90,281	90,296	90,306	90,320	90,344 (18,069) [4,337] {2,168}	90,366 (18,073) [4,338] {2,169}	90,387 (18,077) [4,339] {2,169}
Hamilton	45,106	45,114	45,125	45,134	45,153 (9,031) [2,167] {1,084}	45,171 (9,034) [2,168] {1,084}	45,187 (9,037) [2,169] {1,084}
Knox	51,699	51,723	51,741	51,764	51,828 (10,366) [2,488] {1,244}	51,891 (10,378) [2,491] {1,245}	51,952 (10,390) [2,494] {1,247}
Rutherford	43,525	43,538	43,547	43,552	43,563 (8,713) [2,091] {1,046}	43,572 (8,714) [2,091] {1,046}	43,581 (8,716) [2,092] {1,046}
Shelby	97,937	97,964	97,991	98,004	98,048 (19,610) [4,706] {2,353}	98,087 (19,617) [4,708] {2,354}	98,122 (19,624) [4,710] {2,355}
Sumner	24,338	24,341	24,345	24,345	24,349 (4,870) [1,169] {584}	24,352 (4,870) [1,169] {584}	24,356 (4,871) [1,169] {585}
Williamson	28,334	28,346	28,351	28,351	28,364 (5,673) [1,361] {681}	28,378 (5,676) [1,362] {681}	28,391 (5,678) [1,363] {681}

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.