IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/16/21

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 7/16/21 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
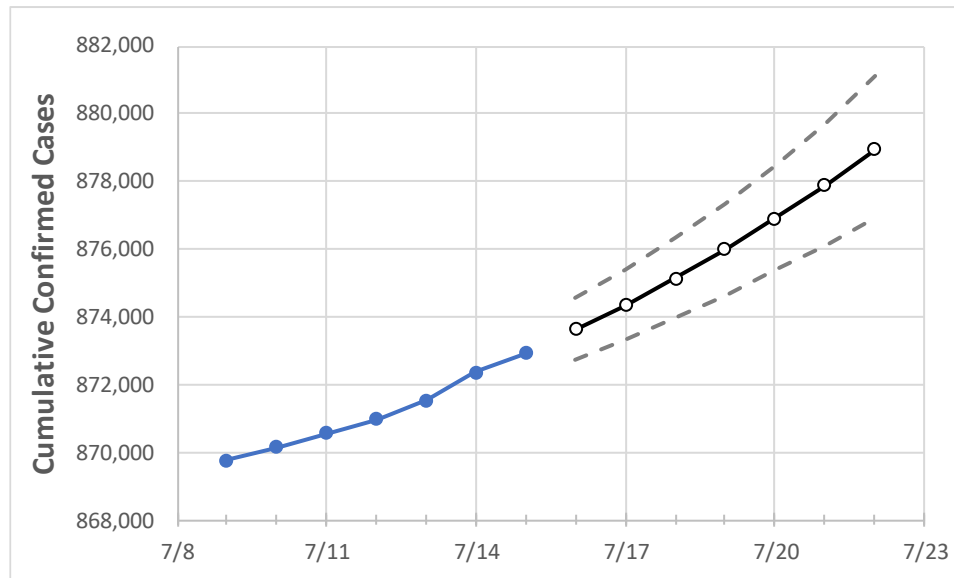
	Actual Confirmed Cases On:				Projected Cases For:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Tennessee	870,971	871,546	872,362	872,934	873,618	874,348	875,137	875,981	876,900	877,879	878,936

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:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Blount	15,993	16,002	16,012	16,026	16,034	16,041	16,049	16,058	16,066	16,075	16,085
Davidson	90,723	90,763	90,858	90,913	90,976	91,042	91,114	91,192	91,277	91,366	91,464
Hamilton	45,712	45,753	45,799	45,840	45,879	45,920	45,964	46,010	46,057	46,108	46,163
Knox	52,277	52,308	52,351	52,319	52,336	52,355	52,374	52,393	52,413	52,434	52,456
Rutherford	43,855	43,867	43,898	43,915	43,934	43,955	43,977	44,000	44,024	44,049	44,076
Shelby	99,794	99,908	100,073	100,262	100,445	100,642	100,856	101,086	101,336	101,602	101,895
Sumner	24,742	24,771	24,810	24,832	24,866	24,903	24,943	24,986	25,031	25,081	25,134
Williamson	28,767	28,781	28,817	28,834	28,855	28,878	28,902	28,929	28,956	28,986	29,019

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:		
	7/12	7/13	7/14	7/15	7/17	7/19	7/21
Blount	15,993	16,002	16,012	16,026	16,041 (3,208) [770] {385}	16,058 (3,212) [771] {385}	16,075 (3,215) [772] {386}
Davidson	90,723	90,763	90,858	90,913	91,042 (18,208) [4,370] {2,185}	91,192 (18,238) [4,377] {2,189}	91,366 (18,273) [4,386] {2,193}
Hamilton	45,712	45,753	45,799	45,840	45,920 (9,184) [2,204] {1,102}	46,010 (9,202) [2,208] {1,104}	46,108 (9,222) [2,213] {1,107}
Knox	52,277	52,308	52,351	52,319	52,355 (10,471) [2,513] {1,257}	52,393 (10,479) [2,515] {1,257}	52,434 (10,487) [2,517] {1,258}
Rutherford	43,855	43,867	43,898	43,915	43,955 (8,791) [2,110] {1,055}	44,000 (8,800) [2,112] {1,056}	44,049 (8,810) [2,114] {1,057}
Shelby	99,794	99,908	100,073	100,262	100,642 (20,128) [4,831] {2,415}	101,086 (20,217) [4,852] {2,426}	101,602 (20,320) [4,877] {2,438}
Sumner	24,742	24,771	24,810	24,832	24,903 (4,981) [1,195] {598}	24,986 (4,997) [1,199] {600}	25,081 (5,016) [1,204] {602}
Williamson	28,767	28,781	28,817	28,834	28,878 (5,776) [1,386] {693}	28,929 (5,786) [1,389] {694}	28,986 (5,797) [1,391] {696}

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.