IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/9/21

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 4/9/21 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
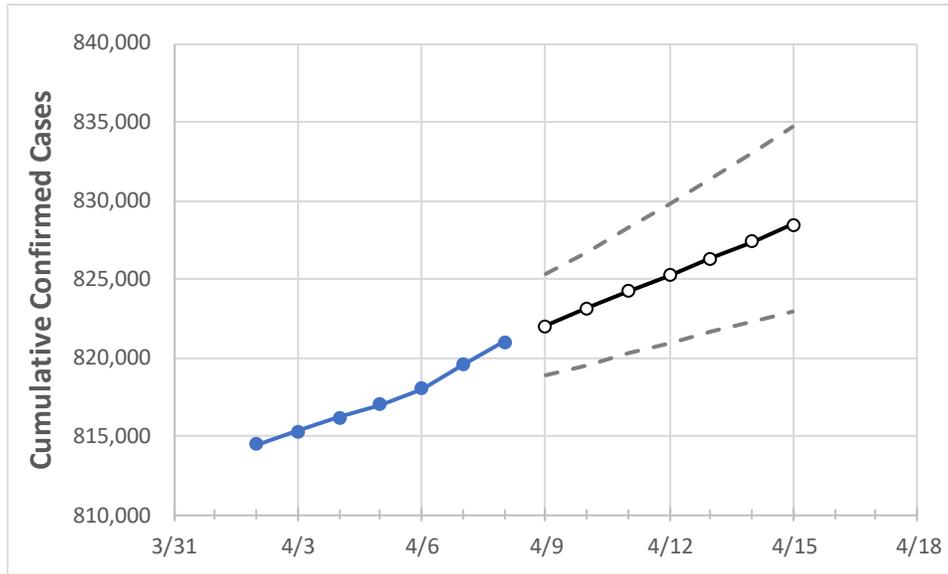
	Actual Confirmed Cases On:				Projected Cases For:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Tennessee	817,022	818,008	819,505	820,965	822,030	823,121	824,192	825,242	826,322	827,377	828,457

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:						
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15
Blount	14,762	14,770	14,798	14,822	14,834	14,845	14,856	14,867	14,878	14,888	14,899
Davidson	86,068	86,170	86,347	86,477	86,591	86,707	86,823	86,938	87,057	87,176	87,290
Hamilton	42,577	42,627	42,677	42,754	42,802	42,849	42,895	42,942	42,988	43,034	43,079
Knox	48,711	48,764	48,836	48,915	48,974	49,030	49,087	49,143	49,198	49,253	49,307
Rutherford	41,160	41,196	41,283	41,366	41,425	41,483	41,539	41,595	41,650	41,705	41,755
Shelby	90,982	91,035	91,178	91,338	91,447	91,554	91,664	91,773	91,880	91,990	92,106
Sumner	22,742	22,768	22,831	22,880	22,919	22,961	23,001	23,040	23,081	23,122	23,163
Williamson	26,790	26,813	26,866	26,912	26,946	26,979	27,012	27,044	27,075	27,107	27,137

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: | | |
	4/5	4/6	4/7	4/8	4/10	4/12	4/14
Blount	14,762	14,770	14,798	14,822	14,845 (2,969) [713] {356}	14,867 (2,973) [714] {357}	14,888 (2,978) [715] {357}
Davidson	86,068	86,170	86,347	86,477	86,707 (17,341) [4,162] {2,081}	86,938 (17,388) [4,173] {2,087}	87,176 (17,435) [4,184] {2,092}
Hamilton	42,577	42,627	42,677	42,754	42,849 (8,570) [2,057] {1,028}	42,942 (8,588) [2,061] {1,031}	43,034 (8,607) [2,066] {1,033}
Knox	48,711	48,764	48,836	48,915	49,030 (9,806) [2,353] {1,177}	49,143 (9,829) [2,359] {1,179}	49,253 (9,851) [2,364] {1,182}
Rutherford	41,160	41,196	41,283	41,366	41,483 (8,297) [1,991] {996}	41,595 (8,319) [1,997] {998}	41,705 (8,341) [2,002] {1,001}
Shelby	90,982	91,035	91,178	91,338	91,554 (18,311) [4,395] {2,197}	91,773 (18,355) [4,405] {2,203}	91,990 (18,398) [4,416] {2,208}
Sumner	22,742	22,768	22,831	22,880	22,961 (4,592) [1,102] {551}	23,040 (4,608) [1,106] {553}	23,122 (4,624) [1,110] {555}
Williamson	26,790	26,813	26,866	26,912	26,979 (5,396) [1,295] {648}	27,044 (5,409) [1,298] {649}	27,107 (5,421) [1,301] {651}

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.