IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/22/21

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 1/22/21 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
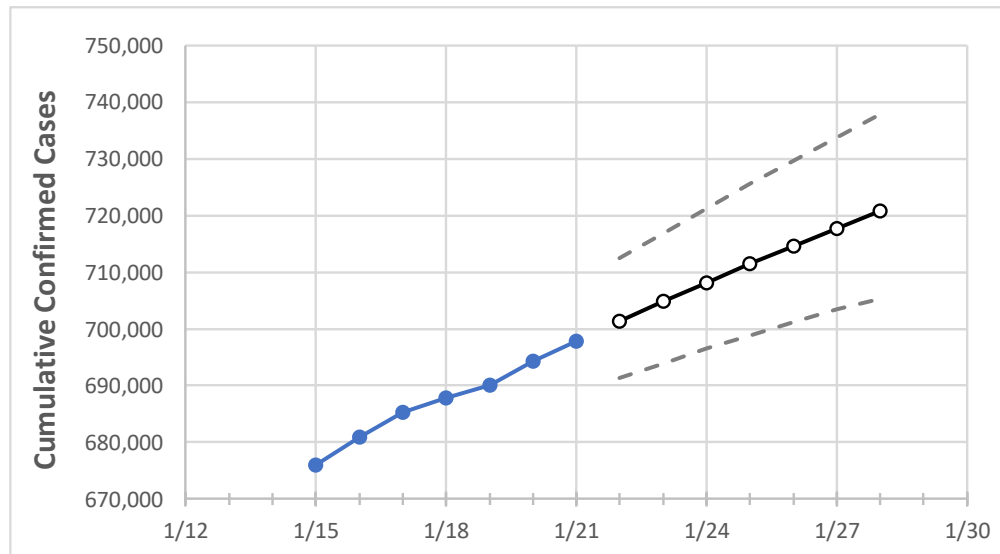
	Actual Confirmed Cases On:				Projected Cases For:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Tennessee	687,751	690,065	694,291	697,783	701,347	704,840	708,142	711,473	714,573	717,732	720,731

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Blount	11,914	12,029	12,146	12,197	12,284	12,372	12,461	12,547	12,635	12,720	12,810
Davidson	70,950	71,148	71,578	71,955	72,338	72,709	73,077	73,436	73,796	74,138	74,466
Hamilton	34,687	34,813	35,049	35,252	35,470	35,677	35,882	36,078	36,276	36,461	36,639
Knox	38,829	38,985	39,306	39,469	39,699	39,931	40,150	40,368	40,572	40,767	40,960
Rutherford	33,228	33,298	33,516	33,687	33,864	34,038	34,213	34,379	34,538	34,698	34,849
Shelby	76,519	76,747	77,157	77,475	77,849	78,212	78,569	78,913	79,255	79,601	79,921
Sumner	18,262	18,322	18,454	18,551	18,651	18,743	18,836	18,926	19,015	19,102	19,188
Williamson	21,449	21,507	21,679	21,776	21,890	22,003	22,110	22,216	22,316	22,410	22,504

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:		
	1/18	1/19	1/20	1/21	1/23	1/25	1/27
Blount	11,914	12,029	12,146	12,197	12,372 (2,474) [594] {297}	12,547 (2,509) [602] {301}	12,720 (2,544) [611] {305}
Davidson	70,950	71,148	71,578	71,955	72,709 (14,542) [3,490] {1,745}	73,436 (14,687) [3,525] {1,762}	74,138 (14,828) [3,559] {1,779}
Hamilton	34,687	34,813	35,049	35,252	35,677 (7,135) [1,712] {856}	36,078 (7,216) [1,732] {866}	36,461 (7,292) [1,750] {875}
Knox	38,829	38,985	39,306	39,469	39,931 (7,986) [1,917] {958}	40,368 (8,074) [1,938] {969}	40,767 (8,153) [1,957] {978}
Rutherford	33,228	33,298	33,516	33,687	34,038 (6,808) [1,634] {817}	34,379 (6,876) [1,650] {825}	34,698 (6,940) [1,665] {833}
Shelby	76,519	76,747	77,157	77,475	78,212 (15,642) [3,754] {1,877}	78,913 (15,783) [3,788] {1,894}	79,601 (15,920) [3,821] {1,910}
Sumner	18,262	18,322	18,454	18,551	18,743 (3,749) [900] {450}	18,926 (3,785) [908] {454}	19,102 (3,820) [917] {458}
Williamson	21,449	21,507	21,679	21,776	22,003 (4,401) [1,056] {528}	22,216 (4,443) [1,066] {533}	22,410 (4,482) [1,076] {538}

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.