IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/5/21

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 11/5/21 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
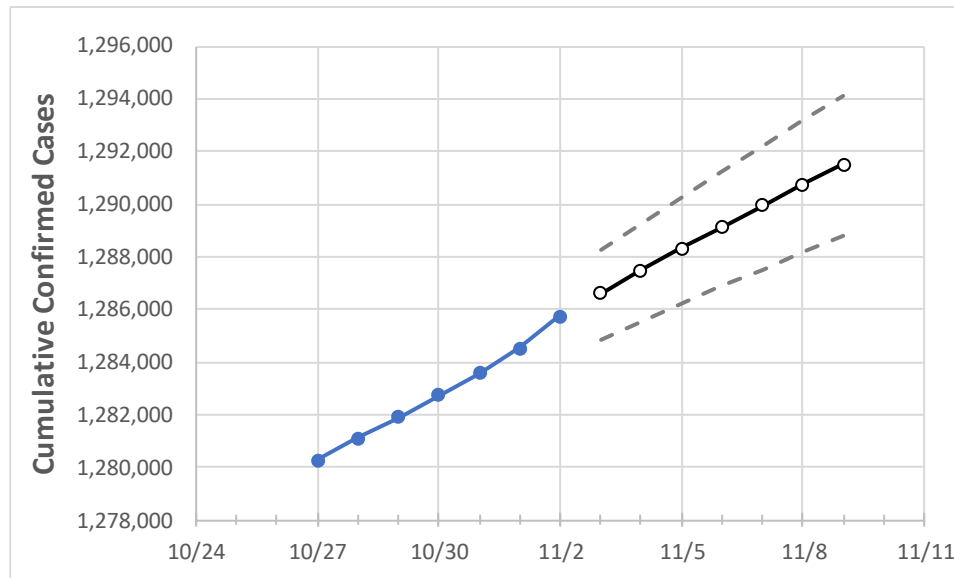
	Actual Confirmed Cases On:				Projected Cases For:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Tennessee	1,282,734	1,283,557	1,284,527	1,285,737	1,286,599	1,287,472	1,288,318	1,289,130	1,289,959	1,290,752	1,291,503

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:						
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9
Blount	23,804	23,819	23,842	23,865	23,882	23,899	23,915	23,931	23,947	23,963	23,978
Davidson	121,500	121,575	121,676	121,760	121,842	121,925	122,005	122,085	122,163	122,241	122,317
Hamilton	63,787	63,831	63,883	63,938	63,982	64,024	64,065	64,107	64,146	64,185	64,223
Knox	78,879	78,940	78,979	79,059	79,115	79,168	79,222	79,272	79,325	79,374	79,422
Rutherford	62,054	62,101	62,170	62,229	62,283	62,335	62,387	62,439	62,489	62,542	62,592
Shelby	144,577	144,651	144,728	144,854	144,935	145,016	145,094	145,172	145,250	145,327	145,404
Sumner	34,345	34,365	34,418	34,452	34,478	34,504	34,529	34,553	34,578	34,603	34,628
Williamson	39,787	39,813	39,839	39,872	39,899	39,926	39,952	39,979	40,005	40,030	40,055

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:		
	10/30	10/31	11/1	11/2	11/4	11/6	11/8
Blount	23,804	23,819	23,842	23,865	23,899 (4,780) [1,147] {574}	23,931 (4,786) [1,149] {574}	23,963 (4,793) [1,150] {575}
Davidson	121,500	121,575	121,676	121,760	121,925 (24,385) [5,852] {2,926}	122,085 (24,417) [5,860] {2,930}	122,241 (24,448) [5,868] {2,934}
Hamilton	63,787	63,831	63,883	63,938	64,024 (12,805) [3,073] {1,537}	64,107 (12,821) [3,077] {1,539}	64,185 (12,837) [3,081] {1,540}
Knox	78,879	78,940	78,979	79,059	79,168 (15,834) [3,800] {1,900}	79,272 (15,854) [3,805] {1,903}	79,374 (15,875) [3,810] {1,905}
Rutherford	62,054	62,101	62,170	62,229	62,335 (12,467) [2,992] {1,496}	62,439 (12,488) [2,997] {1,499}	62,542 (12,508) [3,002] {1,501}
Shelby	144,577	144,651	144,728	144,854	145,016 (29,003) [6,961] {3,480}	145,172 (29,034) [6,968] {3,484}	145,327 (29,065) [6,976] {3,488}
Sumner	34,345	34,365	34,418	34,452	34,504 (6,901) [1,656] {828}	34,553 (6,911) [1,659] {829}	34,603 (6,921) [1,661] {830}
Williamson	39,787	39,813	39,839	39,872	39,926 (7,985) [1,916] {958}	39,979 (7,996) [1,919] {959}	40,030 (8,006) [1,921] {961}

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.