IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/4/21

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 2/4/21 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
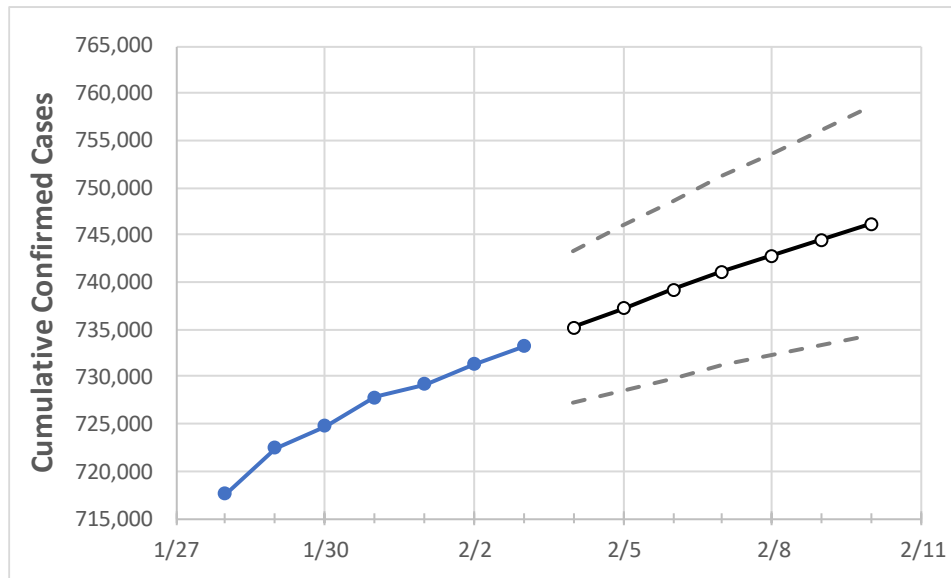
	Actual Confirmed Cases On:				Projected Cases For:						
	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10
Tennessee	727,861	729,187	731,360	733,216	735,249	737,223	739,198	741,076	742,824	744,507	746,168

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:						
	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10
Blount	12,645	12,668	12,701	12,756	12,788	12,816	12,843	12,870	12,895	12,918	12,942
Davidson	74,925	75,072	75,210	75,423	75,625	75,820	76,006	76,188	76,364	76,524	76,687
Hamilton	37,038	37,122	37,296	37,462	37,590	37,715	37,832	37,943	38,050	38,158	38,257
Knox	41,438	41,544	41,732	41,888	42,028	42,162	42,291	42,420	42,541	42,655	42,768
Rutherford	35,110	35,188	35,299	35,394	35,499	35,597	35,692	35,778	35,867	35,952	36,034
Shelby	80,954	81,138	81,360	81,572	81,821	82,063	82,294	82,523	82,746	82,964	83,179
Sumner	19,283	19,339	19,414	19,478	19,536	19,591	19,645	19,697	19,748	19,795	19,842
Williamson	22,987	23,070	23,162	23,250	23,339	23,428	23,514	23,598	23,679	23,760	23,840

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:		
	1/31	2/1	2/2	2/3	2/5	2/7	2/9
Blount	12,645	12,668	12,701	12,756	12,816 (2,563) [615] {308}	12,870 (2,574) [618] {309}	12,918 (2,584) [620] {310}
Davidson	74,925	75,072	75,210	75,423	75,820 (15,164) [3,639] {1,820}	76,188 (15,238) [3,657] {1,829}	76,524 (15,305) [3,673] {1,837}
Hamilton	37,038	37,122	37,296	37,462	37,715 (7,543) [1,810] {905}	37,943 (7,589) [1,821] {911}	38,158 (7,632) [1,832] {916}
Knox	41,438	41,544	41,732	41,888	42,162 (8,432) [2,024] {1,012}	42,420 (8,484) [2,036] {1,018}	42,655 (8,531) [2,047] {1,024}
Rutherford	35,110	35,188	35,299	35,394	35,597 (7,119) [1,709] {854}	35,778 (7,156) [1,717] {859}	35,952 (7,190) [1,726] {863}
Shelby	80,954	81,138	81,360	81,572	82,063 (16,413) [3,939] {1,970}	82,523 (16,505) [3,961] {1,981}	82,964 (16,593) [3,982] {1,991}
Sumner	19,283	19,339	19,414	19,478	19,591 (3,918) [940] {470}	19,697 (3,939) [945] {473}	19,795 (3,959) [950] {475}
Williamson	22,987	23,070	23,162	23,250	23,428 (4,686) [1,125] {562}	23,598 (4,720) [1,133] {566}	23,760 (4,752) [1,141] {570}

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.