IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/16/21

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 2/16/21 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
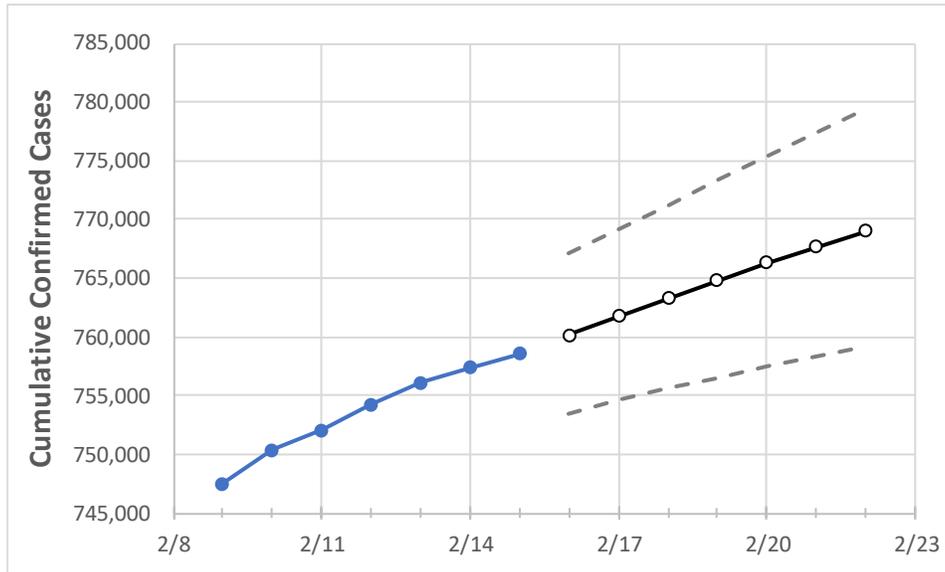
	Actual Confirmed Cases On:				Projected Cases For:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Tennessee	754,279	756,071	757,418	758,561	760,149	761,735	763,280	764,812	766,341	767,702	769,036

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Blount	13,552	13,611	13,655	13,695	13,768	13,839	13,911	13,986	14,060	14,137	14,217
Davidson	78,284	78,756	79,178	79,542	79,866	80,197	80,539	80,876	81,218	81,580	81,939
Hamilton	38,764	38,851	38,925	39,044	39,152	39,258	39,360	39,458	39,554	39,647	39,740
Knox	43,473	43,689	43,947	44,168	44,342	44,516	44,690	44,868	45,035	45,212	45,378
Rutherford	36,689	36,863	37,063	37,217	37,365	37,511	37,659	37,807	37,958	38,108	38,258
Shelby	84,214	84,642	85,092	85,474	85,795	86,117	86,432	86,756	87,084	87,409	87,738
Sumner	20,727	20,789	20,843	20,884	20,987	21,092	21,201	21,309	21,416	21,523	21,635
Williamson	24,291	24,395	24,477	24,549	24,643	24,738	24,831	24,927	25,015	25,106	25,199

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:		
	2/12	2/13	2/14	2/15	2/17	2/19	2/21
Blount	13,552	13,611	13,655	13,695	13,839 (2,768) [664] {332}	13,986 (2,797) [671] {336}	14,137 (2,827) [679] {339}
Davidson	78,284	78,756	79,178	79,542	80,197 (16,039) [3,849] {1,925}	80,876 (16,175) [3,882] {1,941}	81,580 (16,316) [3,916] {1,958}
Hamilton	38,764	38,851	38,925	39,044	39,258 (7,852) [1,884] {942}	39,458 (7,892) [1,894] {947}	39,647 (7,929) [1,903] {952}
Knox	43,473	43,689	43,947	44,168	44,516 (8,903) [2,137] {1,068}	44,868 (8,974) [2,154] {1,077}	45,212 (9,042) [2,170] {1,085}
Rutherford	36,689	36,863	37,063	37,217	37,511 (7,502) [1,801] {900}	37,807 (7,561) [1,815] {907}	38,108 (7,622) [1,829] {915}
Shelby	84,214	84,642	85,092	85,474	86,117 (17,223) [4,134] {2,067}	86,756 (17,351) [4,164] {2,082}	87,409 (17,482) [4,196] {2,098}
Sumner	20,727	20,789	20,843	20,884	21,092 (4,218) [1,012] {506}	21,309 (4,262) [1,023] {511}	21,523 (4,305) [1,033] {517}
Williamson	24,291	24,395	24,477	24,549	24,738 (4,948) [1,187] {594}	24,927 (4,985) [1,196] {598}	25,106 (5,021) [1,205] {603}

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.