IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/18/22

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 3/18/22 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
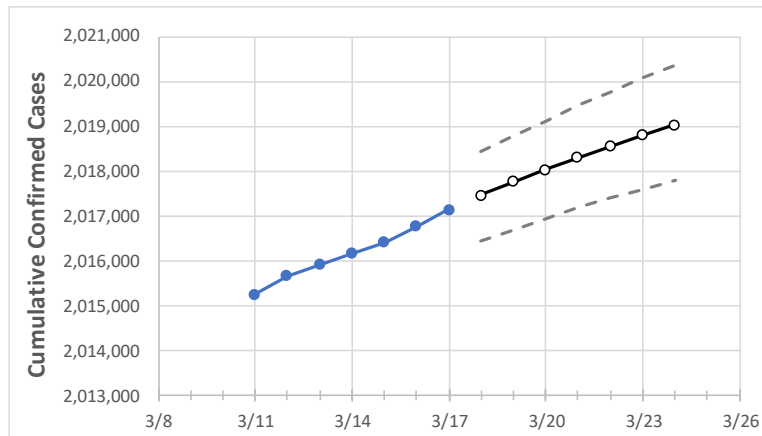
	Actual Confirmed Cases On:				Projected Cases For:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Tennessee	2,016,163	2,016,410	2,016,768	2,017,149	2,017,459	2,017,765	2,018,032	2,018,309	2,018,559	2,018,800	2,019,035

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:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Blount	38,976	38,983	38,990	38,990	39,002	39,013	39,024	39,032	39,041	39,051	39,061
Davidson	190,273	190,340	190,407	190,407	190,485	190,556	190,623	190,698	190,762	190,833	190,898
Hamilton	99,336	99,368	99,400	99,400	99,469	99,523	99,591	99,642	99,702	99,760	99,822
Knox	126,923	126,951	126,979	126,979	127,018	127,051	127,088	127,117	127,147	127,179	127,204
Rutherford	95,422	95,434	95,446	95,446	95,468	95,488	95,505	95,524	95,537	95,554	95,573
Shelby	234,798	234,830	234,862	234,862	234,918	234,965	235,010	235,057	235,100	235,145	235,181
Sumner	53,006	53,016	53,026	53,026	53,039	53,052	53,063	53,075	53,085	53,097	53,107
Williamson	61,755	61,769	61,783	61,783	61,800	61,815	61,829	61,843	61,856	61,869	61,883

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:		
	3/14	3/15	3/16	3/17	3/19	3/21	3/23
Blount	38,976	38,983	38,990	38,990	39,013 (7,803) [1,873] {936}	39,032 (7,806) [1,874] {937}	39,051 (7,810) [1,874] {937}
Davidson	190,273	190,340	190,407	190,407	190,556 (38,111) [9,147] {4,573}	190,698 (38,140) [9,153] {4,577}	190,833 (38,167) [9,160] {4,580}
Hamilton	99,336	99,368	99,400	99,400	99,523 (19,905) [4,777] {2,389}	99,642 (19,928) [4,783] {2,391}	99,760 (19,952) [4,788] {2,394}
Knox	126,923	126,951	126,979	126,979	127,051 (25,410) [6,098] {3,049}	127,117 (25,423) [6,102] {3,051}	127,179 (25,436) [6,105] {3,052}
Rutherford	95,422	95,434	95,446	95,446	95,488 (19,098) [4,583] {2,292}	95,524 (19,105) [4,585] {2,293}	95,554 (19,111) [4,587] {2,293}
Shelby	234,798	234,830	234,862	234,862	234,965 (46,993) [11,278] {5,639}	235,057 (47,011) [11,283] {5,641}	235,145 (47,029) [11,287] {5,643}
Sumner	53,006	53,016	53,026	53,026	53,052 (10,610) [2,546] {1,273}	53,075 (10,615) [2,548] {1,274}	53,097 (10,619) [2,549] {1,274}
Williamson	61,755	61,769	61,783	61,783	61,815 (12,363) [2,967] {1,484}	61,843 (12,369) [2,968] {1,484}	61,869 (12,374) [2,970] {1,485}

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.