IEM's AI Modeling: Short-term COVID-19 Projections

Date: 1/28/22

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 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 1/28/22 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.

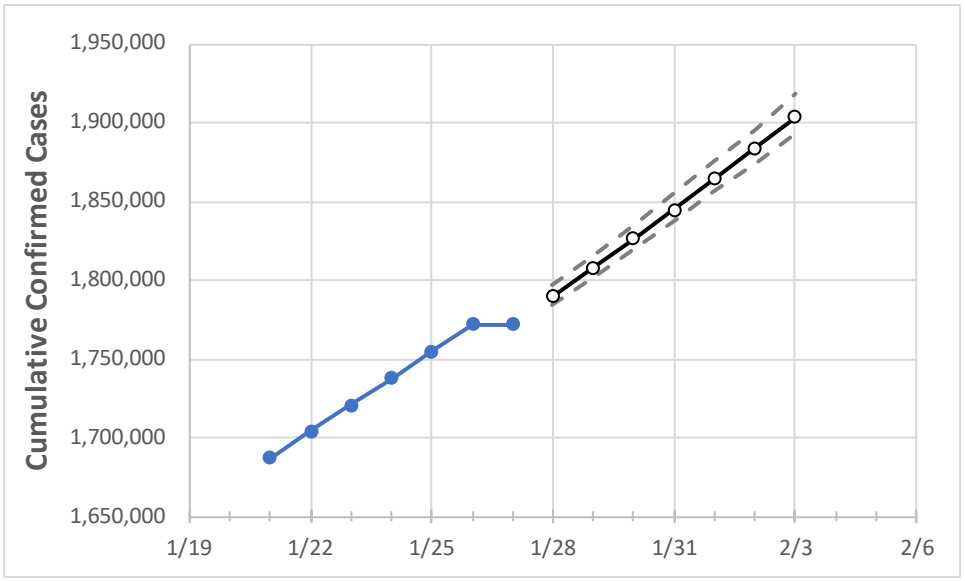
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Tennessee	1,737,886	1,754,835	1,771,783	1,771,783	1,789,770	1,807,936	1,826,202	1,844,955	1,864,144	1,883,716	1,903,899

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Blount	32,406	32,840	33,274	33,274	33,823	34,391	34,967	35,584	36,219	36,872	37,552
Davidson	170,068	171,338	172,608	172,608	173,902	175,175	176,444	177,700	178,967	180,221	181,515
Hamilton	86,097	86,871	87,645	87,645	88,506	89,381	90,270	91,162	92,082	93,015	93,976
Knox	106,651	107,854	109,058	109,058	110,427	111,840	113,272	114,758	116,278	117,849	119,472
Rutherford	83,802	84,659	85,516	85,516	86,430	87,358	88,296	89,260	90,242	91,252	92,289
Shelby	214,644	216,113	217,582	217,582	219,126	220,628	222,087	223,557	224,998	226,423	227,837
Sumner	46,551	46,964	47,376	47,376	47,807	48,242	48,681	49,127	49,582	50,044	50,517
Williamson	54,121	54,598	55,076	55,076	55,566	56,063	56,563	57,074	57,594	58,128	58,673

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:		
	1/24	1/25	1/26	1/27	1/29	1/31	2/2
Blount	32,406	32,840	33,274	33,274	34,391 (6,878) [1,651] {825}	35,584 (7,117) [1,708] {854}	36,872 (7,374) [1,770] {885}
Davidson	170,068	171,338	172,608	172,608	175,175 (35,035) [8,408] {4,204}	177,700 (35,540) [8,530] {4,265}	180,221 (36,044) [8,651] {4,325}
Hamilton	86,097	86,871	87,645	87,645	89,381 (17,876) [4,290] {2,145}	91,162 (18,232) [4,376] {2,188}	93,015 (18,603) [4,465] {2,232}
Knox	106,651	107,854	109,058	109,058	111,840 (22,368) [5,368] {2,684}	114,758 (22,952) [5,508] {2,754}	117,849 (23,570) [5,657] {2,828}
Rutherford	83,802	84,659	85,516	85,516	87,358 (17,472) [4,193] {2,097}	89,260 (17,852) [4,284] {2,142}	91,252 (18,250) [4,380] {2,190}
Shelby	214,644	216,113	217,582	217,582	220,628 (44,126) [10,590] {5,295}	223,557 (44,711) [10,731] {5,365}	226,423 (45,285) [10,868] {5,434}
Sumner	46,551	46,964	47,376	47,376	48,242 (9,648) [2,316] {1,158}	49,127 (9,825) [2,358] {1,179}	50,044 (10,009) [2,402] {1,201}
Williamson	54,121	54,598	55,076	55,076	56,063 (11,213) [2,691] {1,346}	57,074 (11,415) [2,740] {1,370}	58,128 (11,626) [2,790] {1,395}

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.