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

Date: 1/25/21

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 1/25/21 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.

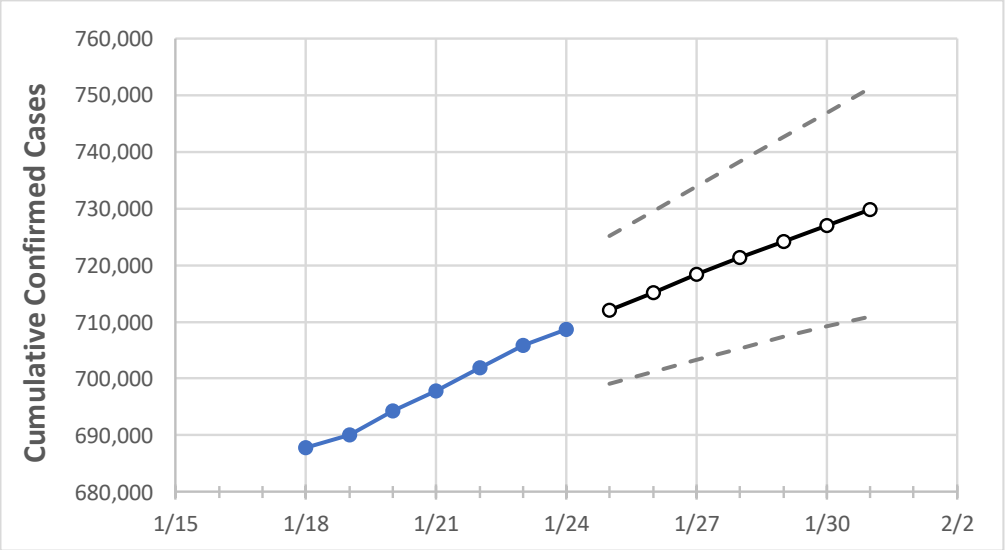
IEM's Modeling Lead

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Tennessee	697,783	701,847	705,876	708,717	712,024	715,202	718,339	721,355	724,221	726,998	729,817

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Blount	12,197	12,267	12,321	12,366	12,439	12,513	12,586	12,658	12,726	12,793	12,860
Davidson	71,955	72,385	72,746	73,045	73,393	73,744	74,071	74,406	74,731	75,057	75,370
Hamilton	35,252	35,466	35,697	35,861	36,053	36,234	36,412	36,584	36,745	36,909	37,058
Knox	39,469	39,701	39,988	40,173	40,380	40,582	40,781	40,976	41,163	41,346	41,522
Rutherford	33,687	33,860	34,042	34,166	34,320	34,472	34,619	34,758	34,898	35,030	35,160
Shelby	77,475	77,971	78,387	78,795	79,173	79,545	79,906	80,265	80,622	80,969	81,311
Sumner	18,551	18,644	18,744	18,819	18,904	18,990	19,070	19,149	19,230	19,305	19,380
Williamson	21,776	21,906	22,041	22,175	22,285	22,392	22,491	22,593	22,690	22,783	22,875

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:		
	1/21	1/22	1/23	1/24	1/26	1/28	1/30
Blount	12,197	12,267	12,321	12,366	12,513 (2,503) [601] {300}	12,658 (2,532) [608] {304}	12,793 (2,559) [614] {307}
Davidson	71,955	72,385	72,746	73,045	73,744 (14,749) [3,540] {1,770}	74,406 (14,881) [3,571] {1,786}	75,057 (15,011) [3,603] {1,801}
Hamilton	35,252	35,466	35,697	35,861	36,234 (7,247) [1,739] {870}	36,584 (7,317) [1,756] {878}	36,909 (7,382) [1,772] {886}
Knox	39,469	39,701	39,988	40,173	40,582 (8,116) [1,948] {974}	40,976 (8,195) [1,967] {983}	41,346 (8,269) [1,985] {992}
Rutherford	33,687	33,860	34,042	34,166	34,472 (6,894) [1,655] {827}	34,758 (6,952) [1,668] {834}	35,030 (7,006) [1,681] {841}
Shelby	77,475	77,971	78,387	78,795	79,545 (15,909) [3,818] {1,909}	80,265 (16,053) [3,853] {1,926}	80,969 (16,194) [3,887] {1,943}
Sumner	18,551	18,644	18,744	18,819	18,990 (3,798) [912] {456}	19,149 (3,830) [919] {460}	19,305 (3,861) [927] {463}
Williamson	21,776	21,906	22,041	22,175	22,392 (4,478) [1,075] {537}	22,593 (4,519) [1,084] {542}	22,783 (4,557) [1,094] {547}

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.