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

Date: 2/2/21

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 2/2/21 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.

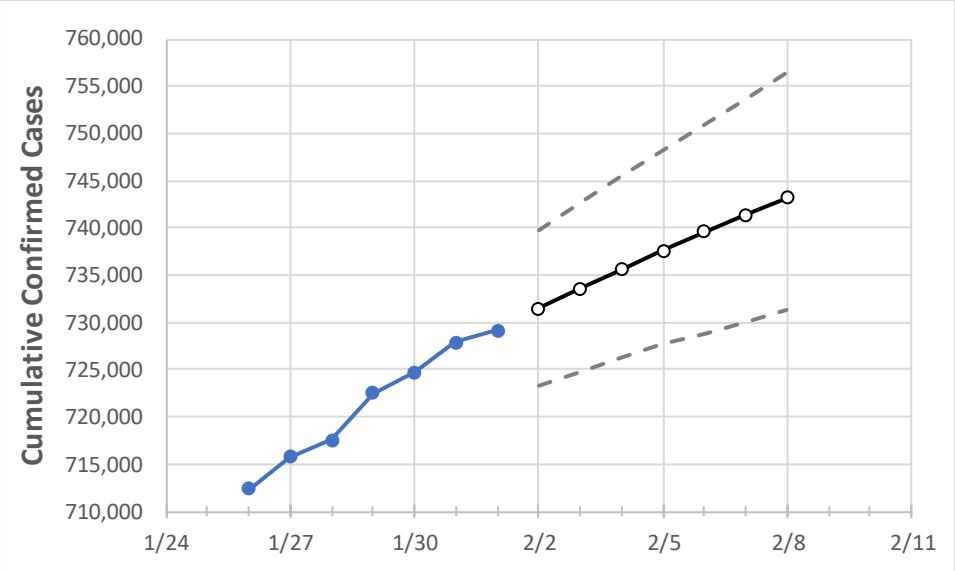
IEM's Modeling Lead

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:						
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8
Tennessee	722,491	724,742	727,861	729,187	731,442	733,587	735,645	737,632	739,587	741,440	743,230

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:						
	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8
Blount	12,596	12,622	12,645	12,668	12,703	12,734	12,767	12,799	12,828	12,857	12,883
Davidson	74,404	74,643	74,925	75,072	75,302	75,523	75,741	75,953	76,154	76,347	76,535
Hamilton	36,803	36,908	37,038	37,122	37,246	37,371	37,487	37,596	37,705	37,807	37,903
Knox	41,070	41,204	41,438	41,544	41,690	41,832	41,968	42,100	42,227	42,350	42,473
Rutherford	34,818	34,951	35,110	35,188	35,294	35,404	35,506	35,605	35,699	35,791	35,883
Shelby	80,369	80,588	80,954	81,138	81,413	81,670	81,930	82,180	82,427	82,665	82,900
Sumner	19,144	19,210	19,283	19,339	19,397	19,452	19,506	19,557	19,608	19,656	19,702
Williamson	22,776	22,845	22,987	23,070	23,164	23,255	23,344	23,431	23,516	23,596	23,676

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:		
	1/29	1/30	1/31	2/1	2/3	2/5	2/7
Blount	12,596	12,622	12,645	12,668	12,734 (2,547) [611] {306}	12,799 (2,560) [614] {307}	12,857 (2,571) [617] {309}
Davidson	74,404	74,643	74,925	75,072	75,523 (15,105) [3,625] {1,813}	75,953 (15,191) [3,646] {1,823}	76,347 (15,269) [3,665] {1,832}
Hamilton	36,803	36,908	37,038	37,122	37,371 (7,474) [1,794] {897}	37,596 (7,519) [1,805] {902}	37,807 (7,561) [1,815] {907}
Knox	41,070	41,204	41,438	41,544	41,832 (8,366) [2,008] {1,004}	42,100 (8,420) [2,021] {1,010}	42,350 (8,470) [2,033] {1,016}
Rutherford	34,818	34,951	35,110	35,188	35,404 (7,081) [1,699] {850}	35,605 (7,121) [1,709] {855}	35,791 (7,158) [1,718] {859}
Shelby	80,369	80,588	80,954	81,138	81,670 (16,334) [3,920] {1,960}	82,180 (16,436) [3,945] {1,972}	82,665 (16,533) [3,968] {1,984}
Sumner	19,144	19,210	19,283	19,339	19,452 (3,890) [934] {467}	19,557 (3,911) [939] {469}	19,656 (3,931) [943] {472}
Williamson	22,776	22,845	22,987	23,070	23,255 (4,651) [1,116] {558}	23,431 (4,686) [1,125] {562}	23,596 (4,719) [1,133] {566}

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.