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

Date: 3/29/21

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 3/29/21 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.

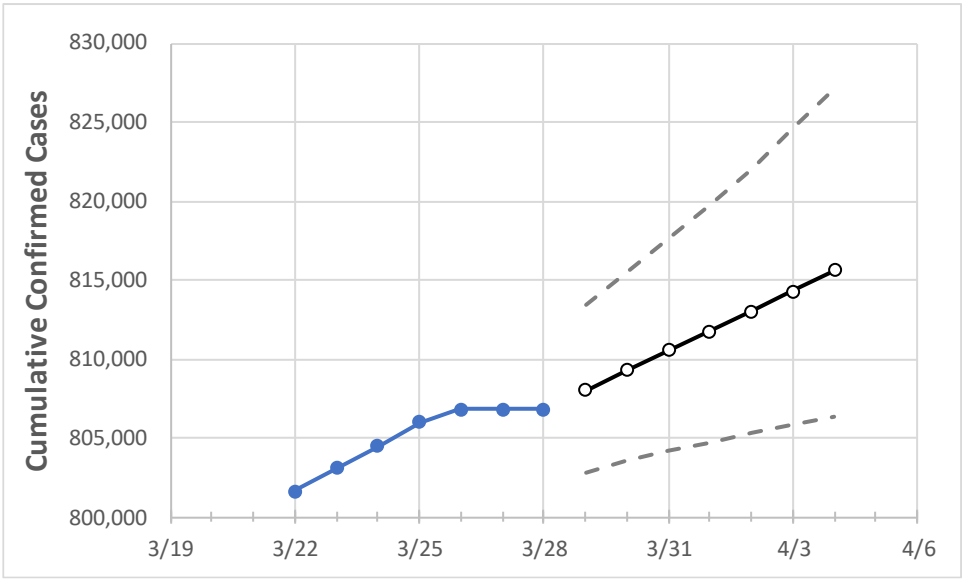
IEM's Modeling Lead

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Tennessee	806,011	806,792	806,792	806,792	808,019	809,271	810,541	811,761	813,027	814,309	815,592

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Blount	14,630	14,643	14,643	14,643	14,666	14,688	14,710	14,733	14,755	14,778	14,799
Davidson	84,787	84,917	84,917	84,917	85,058	85,200	85,343	85,485	85,628	85,783	85,927
Hamilton	42,030	42,089	42,089	42,089	42,152	42,218	42,282	42,347	42,411	42,478	42,545
Knox	47,980	48,078	48,078	48,078	48,169	48,260	48,352	48,444	48,539	48,639	48,737
Rutherford	40,386	40,502	40,502	40,502	40,590	40,676	40,768	40,853	40,940	41,026	41,115
Shelby	89,854	89,964	89,964	89,964	90,076	90,187	90,296	90,407	90,519	90,631	90,743
Sumner	22,331	22,370	22,370	22,370	22,417	22,465	22,515	22,564	22,614	22,664	22,716
Williamson	26,356	26,408	26,408	26,408	26,458	26,509	26,562	26,613	26,664	26,717	26,772

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:		
	3/25	3/26	3/27	3/28	3/30	4/1	4/3
Blount	14,630	14,643	14,643	14,643	14,688 (2,938) [705] {353}	14,733 (2,947) [707] {354}	14,778 (2,956) [709] {355}
Davidson	84,787	84,917	84,917	84,917	85,200 (17,040) [4,090] {2,045}	85,485 (17,097) [4,103] {2,052}	85,783 (17,157) [4,118] {2,059}
Hamilton	42,030	42,089	42,089	42,089	42,218 (8,444) [2,026] {1,013}	42,347 (8,469) [2,033] {1,016}	42,478 (8,496) [2,039] {1,019}
Knox	47,980	48,078	48,078	48,078	48,260 (9,652) [2,316] {1,158}	48,444 (9,689) [2,325] {1,163}	48,639 (9,728) [2,335] {1,167}
Rutherford	40,386	40,502	40,502	40,502	40,676 (8,135) [1,952] {976}	40,853 (8,171) [1,961] {980}	41,026 (8,205) [1,969] {985}
Shelby	89,854	89,964	89,964	89,964	90,187 (18,037) [4,329] {2,164}	90,407 (18,081) [4,340] {2,170}	90,631 (18,126) [4,350] {2,175}
Sumner	22,331	22,370	22,370	22,370	22,465 (4,493) [1,078] {539}	22,564 (4,513) [1,083] {542}	22,664 (4,533) [1,088] {544}
Williamson	26,356	26,408	26,408	26,408	26,509 (5,302) [1,272] {636}	26,613 (5,323) [1,277] {639}	26,717 (5,343) [1,282] {641}

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.