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

Date: 4/26/21

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 4/26/21 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.

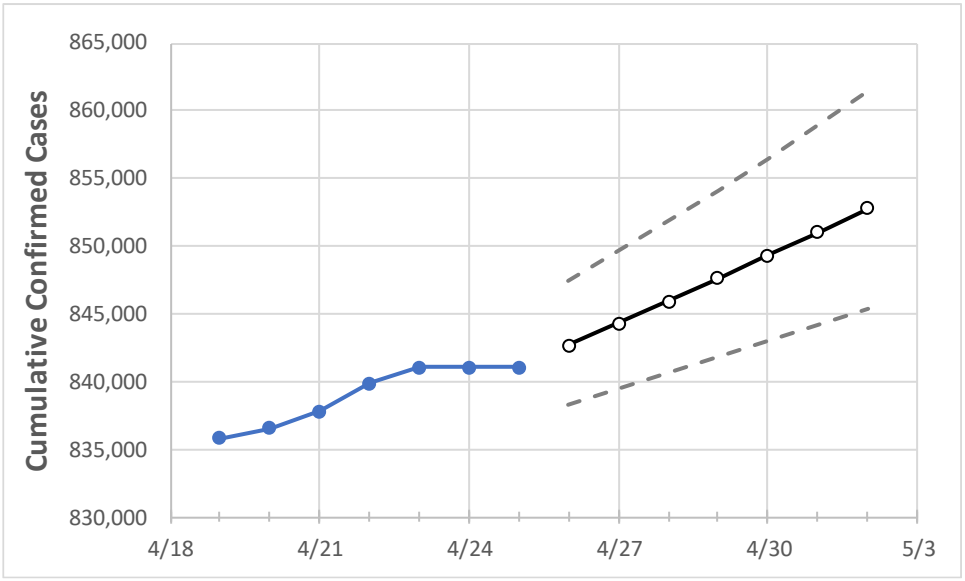
IEM's Modeling Lead

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:						
	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2
Tennessee	839,841	841,049	841,049	841,049	842,653	844,299	845,937	847,598	849,309	851,026	852,793

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:						
	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2
Blount	15,240	15,249	15,249	15,249	15,287	15,327	15,369	15,413	15,459	15,506	15,558
Davidson	88,371	88,479	88,479	88,479	88,641	88,798	88,960	89,128	89,296	89,461	89,632
Hamilton	43,575	43,639	43,639	43,639	43,702	43,765	43,829	43,893	43,960	44,025	44,091
Knox	49,996	50,067	50,067	50,067	50,160	50,251	50,343	50,436	50,531	50,629	50,724
Rutherford	42,477	42,545	42,545	42,545	42,634	42,723	42,819	42,909	43,000	43,097	43,195
Shelby	93,547	93,721	93,721	93,721	93,907	94,099	94,294	94,494	94,697	94,908	95,126
Sumner	23,591	23,628	23,628	23,628	23,689	23,751	23,817	23,881	23,945	24,012	24,084
Williamson	27,637	27,663	27,663	27,663	27,718	27,774	27,832	27,891	27,950	28,008	28,067

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:		
	4/22	4/23	4/24	4/25	4/27	4/29	5/1
Blount	15,240	15,249	15,249	15,249	15,327 (3,065) [736] {368}	15,413 (3,083) [740] {370}	15,506 (3,101) [744] {372}
Davidson	88,371	88,479	88,479	88,479	88,798 (17,760) [4,262] {2,131}	89,128 (17,826) [4,278] {2,139}	89,461 (17,892) [4,294] {2,147}
Hamilton	43,575	43,639	43,639	43,639	43,765 (8,753) [2,101] {1,050}	43,893 (8,779) [2,107] {1,053}	44,025 (8,805) [2,113] {1,057}
Knox	49,996	50,067	50,067	50,067	50,251 (10,050) [2,412] {1,206}	50,436 (10,087) [2,421] {1,210}	50,629 (10,126) [2,430] {1,215}
Rutherford	42,477	42,545	42,545	42,545	42,723 (8,545) [2,051] {1,025}	42,909 (8,582) [2,060] {1,030}	43,097 (8,619) [2,069] {1,034}
Shelby	93,547	93,721	93,721	93,721	94,099 (18,820) [4,517] {2,258}	94,494 (18,899) [4,536] {2,268}	94,908 (18,982) [4,556] {2,278}
Sumner	23,591	23,628	23,628	23,628	23,751 (4,750) [1,140] {570}	23,881 (4,776) [1,146] {573}	24,012 (4,802) [1,153] {576}
Williamson	27,637	27,663	27,663	27,663	27,774 (5,555) [1,333] {667}	27,891 (5,578) [1,339] {669}	28,008 (5,602) [1,344] {672}

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.