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

Date: 1/29/21

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 1/29/21 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.

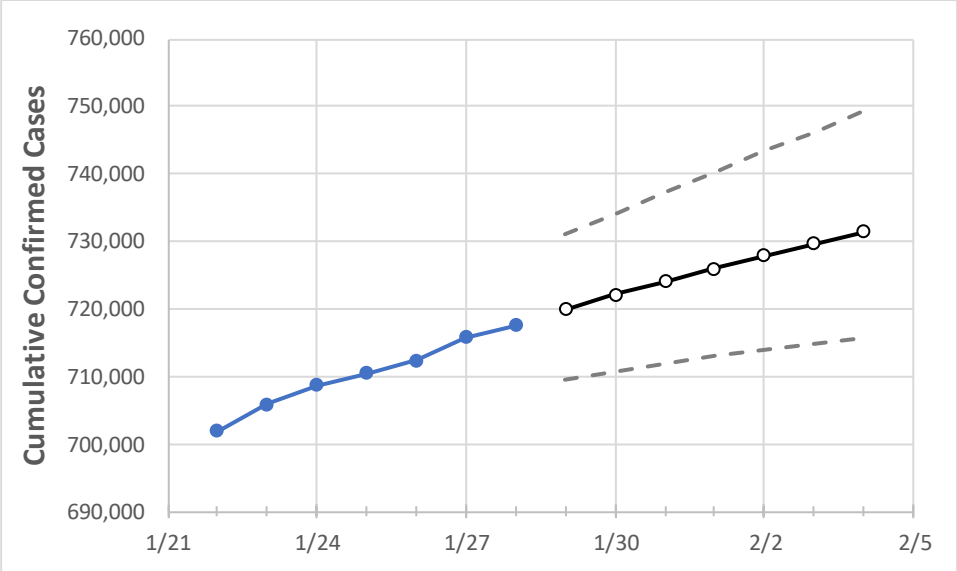
IEM's Modeling Lead

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:						
	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4
Tennessee	710,427	712,406	715,806	717,583	719,891	722,089	724,055	726,000	727,866	729,673	731,466

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:						
	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4
Blount	12,382	12,443	12,491	12,550	12,595	12,639	12,681	12,723	12,761	12,798	12,832
Davidson	73,248	73,395	73,910	74,073	74,323	74,567	74,793	75,013	75,226	75,436	75,641
Hamilton	35,983	36,114	36,369	36,593	36,730	36,862	36,991	37,111	37,230	37,341	37,442
Knox	40,335	40,479	40,739	40,914	41,080	41,242	41,397	41,546	41,685	41,824	41,959
Rutherford	34,271	34,354	34,539	34,645	34,753	34,853	34,951	35,044	35,134	35,221	35,302
Shelby	79,025	79,215	79,637	79,909	80,208	80,486	80,755	81,017	81,277	81,517	81,751
Sumner	18,862	18,891	18,985	19,035	19,092	19,149	19,204	19,258	19,309	19,355	19,402
Williamson	22,259	22,359	22,533	22,593	22,683	22,775	22,860	22,944	23,024	23,100	23,176

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:		
	1/25	1/26	1/27	1/28	1/30	2/1	2/3
Blount	12,382	12,443	12,491	12,550	12,639 (2,528) [607] {303}	12,723 (2,545) [611] {305}	12,798 (2,560) [614] {307}
Davidson	73,248	73,395	73,910	74,073	74,567 (14,913) [3,579] {1,790}	75,013 (15,003) [3,601] {1,800}	75,436 (15,087) [3,621] {1,810}
Hamilton	35,983	36,114	36,369	36,593	36,862 (7,372) [1,769] {885}	37,111 (7,422) [1,781] {891}	37,341 (7,468) [1,792] {896}
Knox	40,335	40,479	40,739	40,914	41,242 (8,248) [1,980] {990}	41,546 (8,309) [1,994] {997}	41,824 (8,365) [2,008] {1,004}
Rutherford	34,271	34,354	34,539	34,645	34,853 (6,971) [1,673] {836}	35,044 (7,009) [1,682] {841}	35,221 (7,044) [1,691] {845}
Shelby	79,025	79,215	79,637	79,909	80,486 (16,097) [3,863] {1,932}	81,017 (16,203) [3,889] {1,944}	81,517 (16,303) [3,913] {1,956}
Sumner	18,862	18,891	18,985	19,035	19,149 (3,830) [919] {460}	19,258 (3,852) [924] {462}	19,355 (3,871) [929] {465}
Williamson	22,259	22,359	22,533	22,593	22,775 (4,555) [1,093] {547}	22,944 (4,589) [1,101] {551}	23,100 (4,620) [1,109] {554}

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.