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

Date: 6/10/21

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 6/10/21 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.

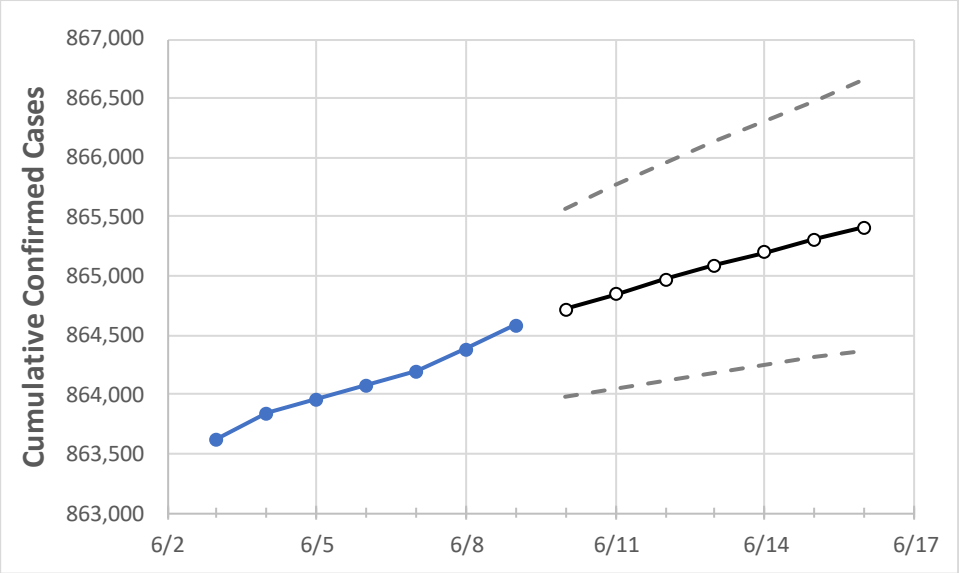
IEM's Modeling Lead

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:						
	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16
Tennessee	864,077	864,195	864,384	864,583	864,717	864,849	864,972	865,092	865,202	865,308	865,415

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:						
	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16
Blount	15,640	15,643	15,641	15,639	15,642	15,645	15,648	15,651	15,654	15,656	15,659
Davidson	90,269	90,281	90,296	90,306	90,318	90,331	90,342	90,353	90,364	90,374	90,384
Hamilton	45,098	45,106	45,114	45,125	45,135	45,144	45,153	45,161	45,168	45,176	45,183
Knox	51,717	51,699	51,723	51,741	51,774	51,810	51,847	51,883	51,920	51,954	51,991
Rutherford	43,523	43,525	43,538	43,547	43,553	43,559	43,564	43,569	43,574	43,579	43,583
Shelby	97,900	97,937	97,964	97,991	98,016	98,039	98,062	98,083	98,103	98,123	98,142
Sumner	24,333	24,338	24,341	24,345	24,347	24,350	24,352	24,354	24,355	24,357	24,359
Williamson	28,324	28,334	28,346	28,351	28,358	28,365	28,372	28,379	28,386	28,393	28,399

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:		
	6/6	6/7	6/8	6/9	6/11	6/13	6/15
Blount	15,640	15,643	15,641	15,639	15,645 (3,129) [751] {375}	15,651 (3,130) [751] {376}	15,656 (3,131) [751] {376}
Davidson	90,269	90,281	90,296	90,306	90,331 (18,066) [4,336] {2,168}	90,353 (18,071) [4,337] {2,168}	90,374 (18,075) [4,338] {2,169}
Hamilton	45,098	45,106	45,114	45,125	45,144 (9,029) [2,167] {1,083}	45,161 (9,032) [2,168] {1,084}	45,176 (9,035) [2,168] {1,084}
Knox	51,717	51,699	51,723	51,741	51,810 (10,362) [2,487] {1,243}	51,883 (10,377) [2,490] {1,245}	51,954 (10,391) [2,494] {1,247}
Rutherford	43,523	43,525	43,538	43,547	43,559 (8,712) [2,091] {1,045}	43,569 (8,714) [2,091] {1,046}	43,579 (8,716) [2,092] {1,046}
Shelby	97,900	97,937	97,964	97,991	98,039 (19,608) [4,706] {2,353}	98,083 (19,617) [4,708] {2,354}	98,123 (19,625) [4,710] {2,355}
Sumner	24,333	24,338	24,341	24,345	24,350 (4,870) [1,169] {584}	24,354 (4,871) [1,169] {584}	24,357 (4,871) [1,169] {585}
Williamson	28,324	28,334	28,346	28,351	28,365 (5,673) [1,362] {681}	28,379 (5,676) [1,362] {681}	28,393 (5,679) [1,363] {681}

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.