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

Date: 3/9/21

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 3/9/21 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.

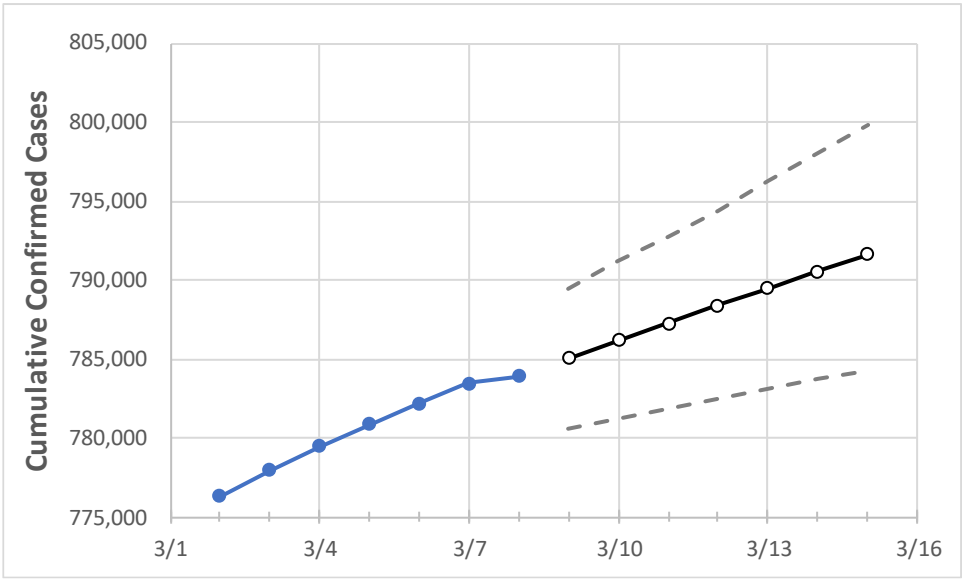
IEM's Modeling Lead

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:						
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15
Tennessee	780,894	782,206	783,484	783,904	785,043	786,179	787,285	788,368	789,488	790,574	791,621

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:						
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15
Blount	14,167	14,189	14,213	14,219	14,240	14,259	14,279	14,297	14,315	14,333	14,350
Davidson	81,978	82,125	82,248	82,300	82,396	82,485	82,577	82,666	82,747	82,825	82,905
Hamilton	40,635	40,698	40,761	40,802	40,855	40,905	40,953	40,999	41,044	41,086	41,127
Knox	46,346	46,447	46,569	46,583	46,679	46,772	46,863	46,951	47,038	47,126	47,209
Rutherford	38,663	38,749	38,847	38,878	38,947	39,016	39,082	39,148	39,213	39,276	39,337
Shelby	87,755	87,879	88,022	88,076	88,175	88,269	88,364	88,453	88,542	88,631	88,716
Sumner	21,498	21,542	21,597	21,607	21,641	21,673	21,705	21,738	21,769	21,800	21,831
Williamson	25,433	25,489	25,536	25,549	25,584	25,617	25,649	25,679	25,709	25,739	25,767

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:		
	3/5	3/6	3/7	3/8	3/10	3/12	3/14
Blount	14,167	14,189	14,213	14,219	14,259 (2,852) [684] {342}	14,297 (2,859) [686] {343}	14,333 (2,867) [688] {344}
Davidson	81,978	82,125	82,248	82,300	82,485 (16,497) [3,959] {1,980}	82,666 (16,533) [3,968] {1,984}	82,825 (16,565) [3,976] {1,988}
Hamilton	40,635	40,698	40,761	40,802	40,905 (8,181) [1,963] {982}	40,999 (8,200) [1,968] {984}	41,086 (8,217) [1,972] {986}
Knox	46,346	46,447	46,569	46,583	46,772 (9,354) [2,245] {1,123}	46,951 (9,390) [2,254] {1,127}	47,126 (9,425) [2,262] {1,131}
Rutherford	38,663	38,749	38,847	38,878	39,016 (7,803) [1,873] {936}	39,148 (7,830) [1,879] {940}	39,276 (7,855) [1,885] {943}
Shelby	87,755	87,879	88,022	88,076	88,269 (17,654) [4,237] {2,118}	88,453 (17,691) [4,246] {2,123}	88,631 (17,726) [4,254] {2,127}
Sumner	21,498	21,542	21,597	21,607	21,673 (4,335) [1,040] {520}	21,738 (4,348) [1,043] {522}	21,800 (4,360) [1,046] {523}
Williamson	25,433	25,489	25,536	25,549	25,617 (5,123) [1,230] {615}	25,679 (5,136) [1,233] {616}	25,739 (5,148) [1,235] {618}

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.