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.

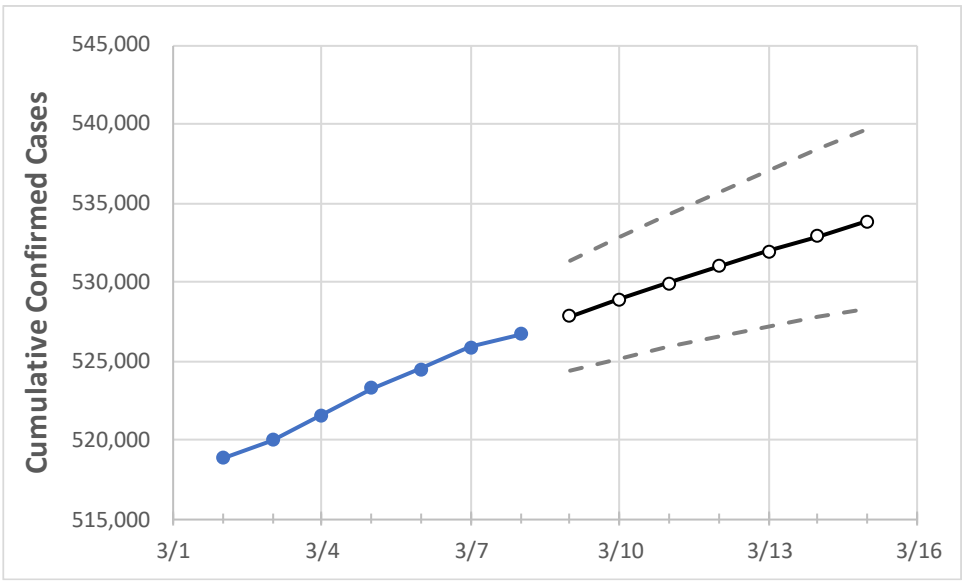
IEM's Modeling Lead

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.

South Carolina 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
South Carolina	523,258	524,457	525,865	526,716	527,827	528,906	529,939	530,975	531,964	532,904	533,829

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.

South Carolina 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
Beaufort	15,625	15,663	15,701	15,728	15,765	15,799	15,833	15,867	15,900	15,932	15,964
Charleston	38,549	38,640	38,724	38,794	38,867	38,938	39,007	39,073	39,138	39,199	39,257
Greenville	64,799	64,963	65,207	65,283	65,463	65,633	65,806	65,974	66,136	66,307	66,472
Kershaw	6,749	6,771	6,785	6,797	6,805	6,812	6,819	6,824	6,830	6,836	6,840
Lexington	30,186	30,244	30,293	30,344	30,391	30,435	30,477	30,516	30,551	30,586	30,618
Richland	41,794	41,880	41,947	42,019	42,087	42,152	42,212	42,272	42,326	42,379	42,429
Spartanburg	36,324	36,424	36,574	36,613	36,700	36,786	36,865	36,947	37,028	37,101	37,176
York	26,939	27,001	27,073	27,120	27,176	27,228	27,277	27,324	27,366	27,405	27,441

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.*

South Carolina 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
Beaufort	15,625	15,663	15,701	15,728	15,799 (3,160) [758] {379}	15,867 (3,173) [762] {381}	15,932 (3,186) [765] {382}
Charleston	38,549	38,640	38,724	38,794	38,938 (7,788) [1,869] {935}	39,073 (7,815) [1,875] {938}	39,199 (7,840) [1,882] {941}
Greenville	64,799	64,963	65,207	65,283	65,633 (13,127) [3,150] {1,575}	65,974 (13,195) [3,167] {1,583}	66,307 (13,261) [3,183] {1,591}
Kershaw	6,749	6,771	6,785	6,797	6,812 (1,362) [327] {163}	6,824 (1,365) [328] {164}	6,836 (1,367) [328] {164}
Lexington	30,186	30,244	30,293	30,344	30,435 (6,087) [1,461] {730}	30,516 (6,103) [1,465] {732}	30,586 (6,117) [1,468] {734}
Richland	41,794	41,880	41,947	42,019	42,152 (8,430) [2,023] {1,012}	42,272 (8,454) [2,029] {1,015}	42,379 (8,476) [2,034] {1,017}
Spartanburg	36,324	36,424	36,574	36,613	36,786 (7,357) [1,766] {883}	36,947 (7,389) [1,773] {887}	37,101 (7,420) [1,781] {890}
York	26,939	27,001	27,073	27,120	27,228 (5,446) [1,307] {653}	27,324 (5,465) [1,312] {656}	27,405 (5,481) [1,315] {658}

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.