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

Date: 2/26/21

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 2/26/21 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.

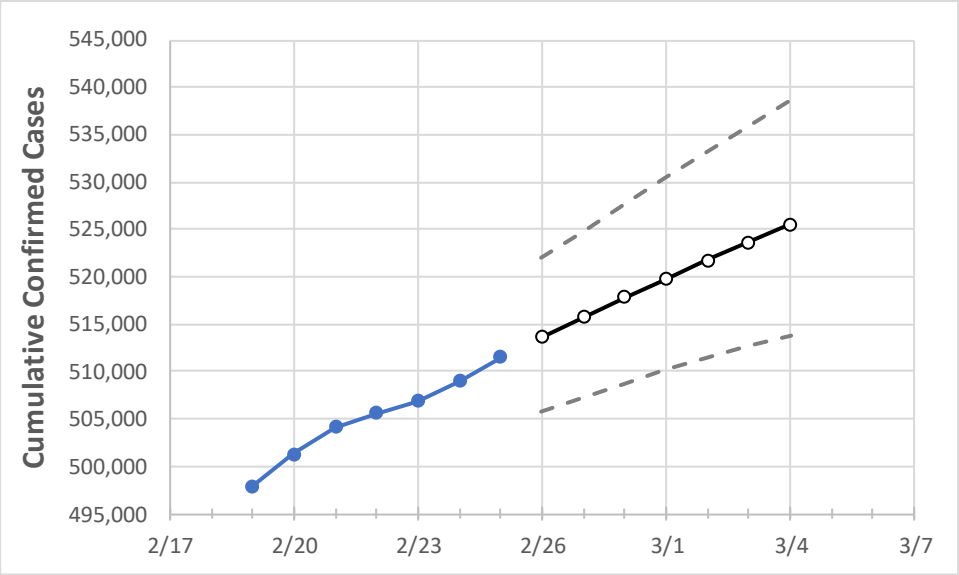
IEM's Modeling Lead

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.

South Carolina State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4
South Carolina	505,589	506,912	509,044	511,546	513,657	515,744	517,810	519,790	521,735	523,667	525,561

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:						
	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4
Beaufort	15,112	15,141	15,196	15,263	15,311	15,359	15,404	15,447	15,491	15,532	15,573
Charleston	37,414	37,490	37,621	37,773	37,905	38,034	38,156	38,276	38,393	38,502	38,609
Greenville	62,644	62,770	63,027	63,241	63,432	63,617	63,794	63,970	64,140	64,307	64,467
Kershaw	6,536	6,587	6,627	6,649	6,689	6,727	6,765	6,803	6,841	6,879	6,917
Lexington	29,138	29,299	29,437	29,543	29,738	29,929	30,123	30,315	30,505	30,690	30,873
Richland	40,504	40,627	40,844	40,962	41,152	41,345	41,536	41,724	41,915	42,097	42,282
Spartanburg	35,028	35,116	35,265	35,456	35,602	35,740	35,881	36,010	36,137	36,268	36,389
York	25,686	25,797	25,964	26,351	26,519	26,687	26,850	27,022	27,199	27,372	27,548

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:		
	2/22	2/23	2/24	2/25	2/27	3/1	3/3
Beaufort	15,112	15,141	15,196	15,263	15,359 (3,072) [737] {369}	15,447 (3,089) [741] {371}	15,532 (3,106) [746] {373}
Charleston	37,414	37,490	37,621	37,773	38,034 (7,607) [1,826] {913}	38,276 (7,655) [1,837] {919}	38,502 (7,700) [1,848] {924}
Greenville	62,644	62,770	63,027	63,241	63,617 (12,723) [3,054] {1,527}	63,970 (12,794) [3,071] {1,535}	64,307 (12,861) [3,087] {1,543}
Kershaw	6,536	6,587	6,627	6,649	6,727 (1,345) [323] {161}	6,803 (1,361) [327] {163}	6,879 (1,376) [330] {165}
Lexington	29,138	29,299	29,437	29,543	29,929 (5,986) [1,437] {718}	30,315 (6,063) [1,455] {728}	30,690 (6,138) [1,473] {737}
Richland	40,504	40,627	40,844	40,962	41,345 (8,269) [1,985] {992}	41,724 (8,345) [2,003] {1,001}	42,097 (8,419) [2,021] {1,010}
Spartanburg	35,028	35,116	35,265	35,456	35,740 (7,148) [1,716] {858}	36,010 (7,202) [1,728] {864}	36,268 (7,254) [1,741] {870}
York	25,686	25,797	25,964	26,351	26,687 (5,337) [1,281] {640}	27,022 (5,404) [1,297] {649}	27,372 (5,474) [1,314] {657}

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.