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

Date: 3/5/21

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 3/5/21 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.

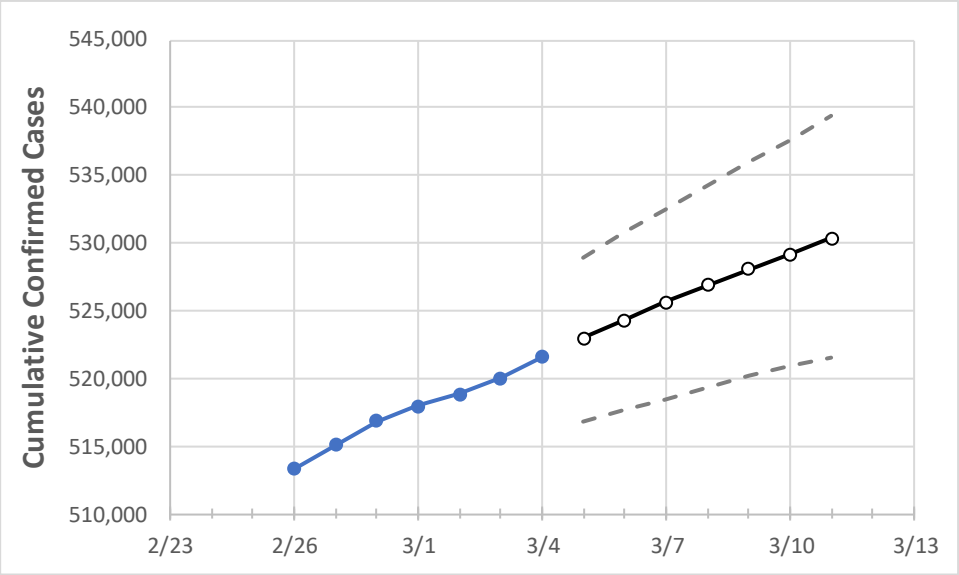
IEM's Modeling Lead

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
South Carolina	517,976	518,823	519,996	521,563	522,946	524,288	525,594	526,863	528,051	529,211	530,344

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Beaufort	15,470	15,500	15,528	15,564	15,603	15,641	15,677	15,714	15,750	15,786	15,819
Charleston	38,212	38,289	38,361	38,456	38,539	38,618	38,692	38,765	38,834	38,901	38,961
Greenville	63,961	64,064	64,238	64,515	64,672	64,821	64,968	65,103	65,239	65,373	65,504
Kershaw	6,709	6,717	6,726	6,735	6,754	6,773	6,791	6,809	6,825	6,841	6,856
Lexington	29,878	29,924	30,013	30,097	30,195	30,287	30,381	30,468	30,552	30,633	30,708
Richland	41,444	41,499	41,575	41,696	41,819	41,942	42,062	42,175	42,285	42,391	42,497
Spartanburg	35,907	35,962	36,064	36,197	36,293	36,387	36,472	36,551	36,632	36,709	36,782
York	26,696	26,745	26,801	26,855	26,964	27,071	27,176	27,277	27,378	27,475	27,569

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:		
	3/1	3/2	3/3	3/4	3/6	3/8	3/10
Beaufort	15,470	15,500	15,528	15,564	15,641 (3,128) [751] {375}	15,714 (3,143) [754] {377}	15,786 (3,157) [758] {379}
Charleston	38,212	38,289	38,361	38,456	38,618 (7,724) [1,854] {927}	38,765 (7,753) [1,861] {930}	38,901 (7,780) [1,867] {934}
Greenville	63,961	64,064	64,238	64,515	64,821 (12,964) [3,111] {1,556}	65,103 (13,021) [3,125] {1,562}	65,373 (13,075) [3,138] {1,569}
Kershaw	6,709	6,717	6,726	6,735	6,773 (1,355) [325] {163}	6,809 (1,362) [327] {163}	6,841 (1,368) [328] {164}
Lexington	29,878	29,924	30,013	30,097	30,287 (6,057) [1,454] {727}	30,468 (6,094) [1,462] {731}	30,633 (6,127) [1,470] {735}
Richland	41,444	41,499	41,575	41,696	41,942 (8,388) [2,013] {1,007}	42,175 (8,435) [2,024] {1,012}	42,391 (8,478) [2,035] {1,017}
Spartanburg	35,907	35,962	36,064	36,197	36,387 (7,277) [1,747] {873}	36,551 (7,310) [1,754] {877}	36,709 (7,342) [1,762] {881}
York	26,696	26,745	26,801	26,855	27,071 (5,414) [1,299] {650}	27,277 (5,455) [1,309] {655}	27,475 (5,495) [1,319] {659}

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.