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

Date: 2/16/21

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 2/16/21 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.

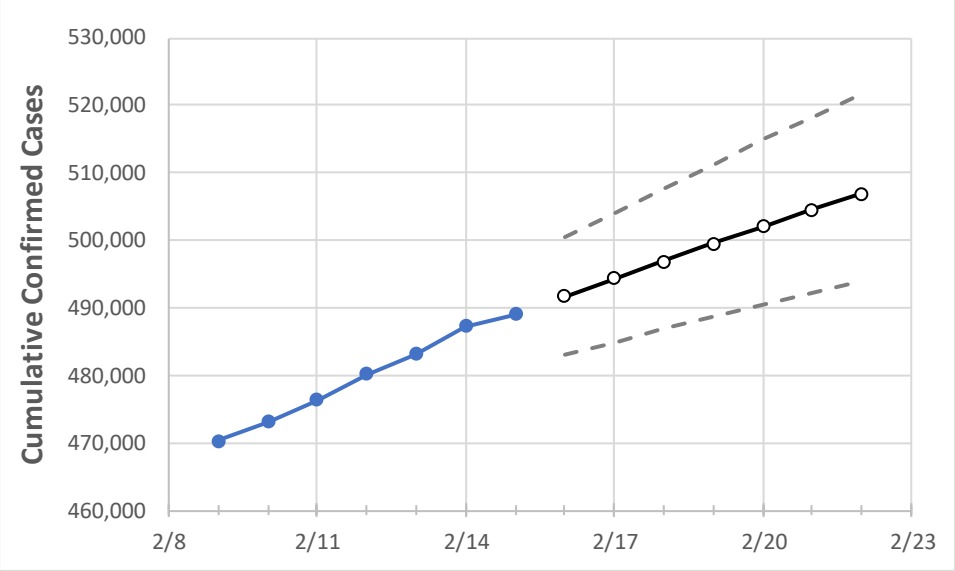
IEM's Modeling Lead

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
South Carolina	480,157	483,140	487,293	489,018	491,661	494,290	496,912	499,464	501,981	504,489	506,963

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Beaufort	14,525	14,587	14,659	14,690	14,755	14,817	14,878	14,936	14,994	15,050	15,103
Charleston	35,662	35,877	36,256	36,381	36,609	36,828	37,050	37,270	37,489	37,708	37,927
Greenville	60,248	60,548	60,996	61,130	61,427	61,718	62,012	62,293	62,564	62,833	63,098
Kershaw	6,106	6,156	6,210	6,251	6,293	6,335	6,377	6,417	6,457	6,497	6,537
Lexington	26,962	27,209	27,463	27,631	27,820	28,005	28,195	28,383	28,572	28,762	28,950
Richland	38,251	38,490	38,802	38,966	39,159	39,350	39,538	39,726	39,913	40,093	40,273
Spartanburg	33,239	33,442	33,740	33,841	34,072	34,301	34,529	34,749	34,965	35,185	35,392
York	24,070	24,232	24,484	24,594	24,744	24,892	25,040	25,187	25,335	25,480	25,628

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:		
	2/12	2/13	2/14	2/15	2/17	2/19	2/21
Beaufort	14,525	14,587	14,659	14,690	14,817 (2,963) [711] {356}	14,936 (2,987) [717] {358}	15,050 (3,010) [722] {361}
Charleston	35,662	35,877	36,256	36,381	36,828 (7,366) [1,768] {884}	37,270 (7,454) [1,789] {894}	37,708 (7,542) [1,810] {905}
Greenville	60,248	60,548	60,996	61,130	61,718 (12,344) [2,962] {1,481}	62,293 (12,459) [2,990] {1,495}	62,833 (12,567) [3,016] {1,508}
Kershaw	6,106	6,156	6,210	6,251	6,335 (1,267) [304] {152}	6,417 (1,283) [308] {154}	6,497 (1,299) [312] {156}
Lexington	26,962	27,209	27,463	27,631	28,005 (5,601) [1,344] {672}	28,383 (5,677) [1,362] {681}	28,762 (5,752) [1,381] {690}
Richland	38,251	38,490	38,802	38,966	39,350 (7,870) [1,889] {944}	39,726 (7,945) [1,907] {953}	40,093 (8,019) [1,924] {962}
Spartanburg	33,239	33,442	33,740	33,841	34,301 (6,860) [1,646] {823}	34,749 (6,950) [1,668] {834}	35,185 (7,037) [1,689] {844}
York	24,070	24,232	24,484	24,594	24,892 (4,978) [1,195] {597}	25,187 (5,037) [1,209] {604}	25,480 (5,096) [1,223] {612}

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.